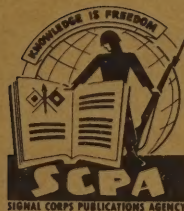


**INSTRUCTION BOOK
FOR
RADIO RECEIVER R-394/U**



**MANUFACTURED BY
MOTOROLA, INC.
CHICAGO, ILLINOIS
ORDER NO. 11661-PHILA-52-93
17 MARCH 1953**

ADDENDA NO. 3 TO INSTRUCTION BOOK FOR RADIO RECEIVER R-394/U

The following information, published on Order No. 11661-Phila-52, provides information to be added to the instruction book. These addenda supersede Addenda No. 1, 30 March 1953 and Addenda No. 2, 15 May 1953.

Personnel using this equipment and having custody of these addenda will enter suitable notations beside each affected paragraph and figure in the instruction book to indicate the presence of this supplementary information.

Page 5. Par. 7a(6). Change to read: RELAY plug-in unit (Receiver Subassembly MX-1547/G).

Page 6. Par. 7c(2). Line 8. Change "VR31" to read: V34.

Page 9. Par. 13c. Add the following at the end of sub-paragraph c.

When using Power Supply PP-846/U, connect a jumper between terminal 7 and 8 of terminal board TB251 on receiver base.

Page 11. Figure 10. The callouts for tubes V51 and V52 should be reversed.

Page 15. Par. 17. Caution. First sentence. Change the first sentence to read: The crystal and the thermostat are similar in appearance but the thermostat case is painted black.

Page 24. Par. 38c. Normal indications column. Item 8(a). Line 2. Change "quieted" to quieted.

Page 25. Par. 39c(4). Delete "&".

Page 25. Par. 39c(6). Change to read: RELAY (Receiver Subassembly MX-1547/G (optional use)).

Page 25. Par. 40a. Line 6. Delete, "signal plus noise-to-noise ratio and the".

Page 26. Par. 42b. Line 5. Change the third and fourth sentences to read: This tube has a

directly heated filament to which voltage is applied through filament choke L5. This choke and r-f bypass capacitors C15 and C26 prevent stray r-f from entering the filament circuit.

Page 26. Par. 43a. Line 4. Change "one" to read: two.

Page 27. Figure 17. Change tube type of V33 from "5678" to read: 1AD4.

Page 29. Figure 18. Delete coil L14 and connect the top of coil L5 directly to filament pin 5 of V2. Add capacitor C26 2000 (UUF) from filament pin 5 of V2 to ground.

Page 31. Par. 44a. Line 16. Add the following after "low voltage circuits". Capacitor C49 across the thermostat (S31) contacts stabilizes the oscillator during certain periods of the oven operation.

Page 31. Par. 44c. Lines 9 and 10. Change "C40A" to read: C40 and "C40B" to read: C50.

Page 32. Figure 20. Make the following changes.

Add capacitor C49 (.01 UF) across terminals 2 and 8 of crystal oven E31.

On C40A, delete the dashed line enclosure and letter A, change the value to 2000.

On C40B, delete the dashed line enclosure and letter B, change to C50 2000.

Page 33. Figure 21. L51. Change "7.5 UF" to read: 7.5 UH.

Page 34. Figure 22. Change "P2" to read: P51, in both places.

Page 36. Figure 24. Insert resistor R92 (10K) in the common lead to B+ from the junction of terminal 1 of Z81 and the bottom of resistor R94. Connect capacitor C86 (.022 UF) from pin 2 of V83 to ground.

Page 37. Par. 53. Line 12. Delete the sentence beginning: "The age circuit".

Page 42. Figure 30. Change the four reference level voltages on the left hand side of the curve as follows: "+30.4V" to +31.4V; "+20.8V" to +21.8V; "-20.8V" to -19.8V; and "-30.4V" to -29.4V.

Page 45. Figure 32. Change "+155V" at terminal F of plug P121 to read: +150V.

Page 47. Figure 33. Title. Change "PP-486/U" to read: PP-846/U.

Page 49. Make the following changes. Figure 35. Interchange resistors R253 and R251.

Figure 35. Add the following note. Note: When using Power Supply PP-846/U, connect a jumper between terminal 7 and 8 of terminal board TB251 on receiver base.

Par. 62d. Line 7. Change "50" to read: 48.

Page 51. Figure 36. Make the following changes.

Add a lead connecting terminal 1 on P251 to terminal 19 on P252. Mark terminal 1 on P251 to read: ±12V D-C.

Change R251 from "10" to 22 ohms.

Number terminals on TB252 as follows:

Top row (left to right) 1, 2, 3.

Bottom row (left to right) 4, 5, 6.

Add the following after Note 5. 6. A jumper is connected between terminals 7 and 8 of TB251 when Power Supply PP-846/U is used.

Page 57. Par. 68a. Add the following to the end of subparagraph a.

A jumper is connected between terminals 7 and 8 of terminal board TB251 when Power Supply PP-846/U is used.

Page 60. Par. 70a. Add the following to the end of subparagraph a.

When Power Supply PP-846/U is used, installation feature is not required because of better regulation in the power supply. Therefore a jumper must be connected from terminal 7 and 8 of terminal board TB251 on the receiver base in order to bypass the interlock circuit.

Page 61. Figure 43. Make the following changes:

Change "R144 15K" to read: R143 1.5 MEG.

Insert resistor R144 (15K) between the top of R145 and pin 4 of V125.

Change name of V122 from "AUDIO OUTPUT" to read: AUDIO POWER AMPL.

Page 63. Figure 44. Insert figure 44.1 after figure 44.

Page 65. Figure 45. Insert figure 45.1 after figure 45.

Page 67. Figure 48. Insert figure 48.1 after figure 48.

Page 67. Figure 49. Insert figure 49.1 after figure 49.

Page 68. Figure 50. Insert figure 50.1 after figure 50.

Page 70. Figure 51. Insert figure 51.1 after figure 51.

Page 72. Figure 52. Insert figure 52.1 after figure 52.

Page 73. Figure 53. Insert figure 53.1 after figure 53.

Page 74. Figure 55. Insert figure 55.1 after figure 55.

Page 75. Par. 75a. Chart. Delete last item (L14).

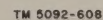
Page 76. Par. 77f. Line 1, line 4 and line 8. Change "Low-pass" to read: I-f.

Page 81. Figure 56. Interchange resistors R253 and R251.

Page 83. Figure 60. Insert figure 60.1 after figure 60.

Page 84. Figure 62. Interchange resistors R51 and R52.

Page 85. Figure 54. Insert figure 64.1 after figure 64.



Page 33. Figure 21. L51. Change "7.5 UF" to read: 7.5 UH.

Page 34. Figure 22. Change "P2" to read: P51, in both places.

Page 36. Figure 24. Insert resistor R92 (10K) in the common lead to B+ from the junction of terminal 1 of Z81 and the bottom of resistor R94. Connect capacitor C86 (.022 UF) from pin 2 of V83 to ground.

Page 37. Par. 53. Line 12. Delete the sentence beginning: "The age circuit".

Page 42. Figure 30. Change the four reference level voltages on the left hand side of the curve as follows: "+30.4V" to +31.4V; "+20.8V" to +21.8V; "-20.8V" to -19.8V; and "-30.4V" to -29.4V.

Page 45. Figure 32. Change "+155V" at terminal F of plug P121 to read: +150V.

Page 47. Figure 33. Title. Change "PP-486/U" to read: PP-846/U.

Page 49. Make the following changes. Figure 35. Interchange resistors R253 and R251.

Figure 35. Add the following note. Note: When using Power Supply PP-846/U, connect a jumper between terminal 7 and 8 of terminal board TB251 on receiver base.

Par. 62d. Line 7. Change "50" to read: 48.

Page 51. Figure 36. Make the following changes.

Add a lead connecting terminal 1 on P251 to terminal 19 on P252. Mark terminal 1 on P251 to read: $\pm 12V$ D-C.

Change R251 from "10" to 22 ohms.

Number terminals on TB252 as follows:

Top row (left to right) 1, 2, 3.

Bottom row (left to right) 4, 5, 6.

Add the following after Note 5. 6. A jumper is connected between terminals 7 and 8 of TB251 when Power Supply PP-846/U is used.

Page 57. Par. 68a. Add the following to the end of subparagraph a.

A jumper is connected between terminals 7 and 8 of terminal board TB251 when Power Supply PP-846/U is used.

Page 60. Par. 70a. Add the following to the end of subparagraph a.

When Power Supply PP-846/U is used, installation feature is not required because of better regulation in the power supply. Therefore a jumper must be connected from terminal 7 and 8 of terminal board TB251 on the receiver base in order to bypass the interlock circuit.

Page 61. Figure 43. Make the following changes:

Change "R144 15K" to read: R143 1.5 MEG.

Insert resistor R144 (15K) between the top of R145 and pin 4 of V125.

Change name of V122 from "AUDIO OUTPUT" to read: AUDIO POWER AMPL.

Page 63. Figure 44. Insert figure 44.1 after figure 44.

Page 65. Figure 45. Insert figure 45.1 after figure 45.

Page 67. Figure 48. Insert figure 48.1 after figure 48.

Page 67. Figure 49. Insert figure 49.1 after figure 49.

Page 68. Figure 50. Insert figure 50.1 after figure 50.

Page 70. Figure 51. Insert figure 51.1 after figure 51.

Page 72. Figure 52. Insert figure 52.1 after figure 52.

Page 73. Figure 53. Insert figure 53.1 after figure 53.

Page 74. Figure 55. Insert figure 55.1 after figure 55.

Page 75. Par. 75a. Chart. Delete last item (L14).

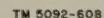
Page 76. Par. 77f. Line 1, line 4 and line 8. Change "Low-pass" to read: I-f.

Page 81. Figure 56. Interchange resistors R253 and R251.

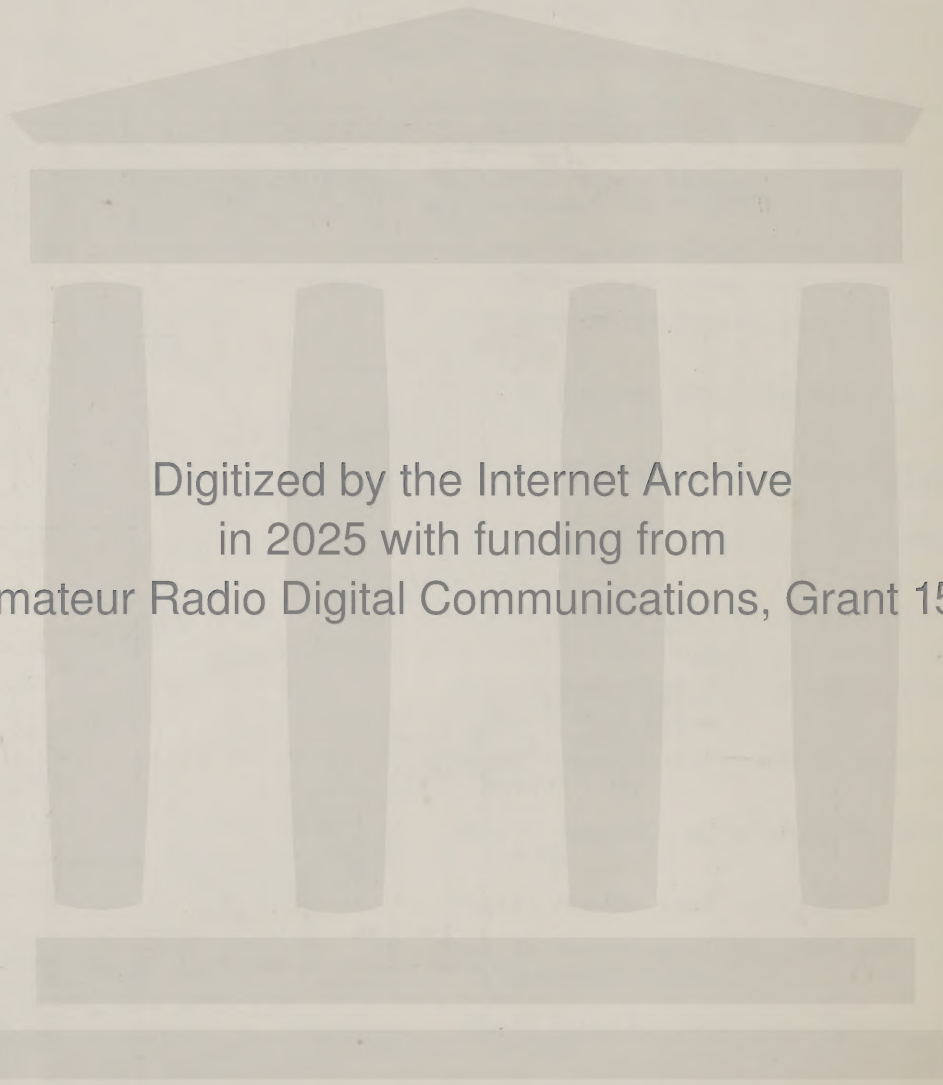
Page 83. Figure 60. Insert figure 60.1 after figure 60.

Page 84. Figure 62. Interchange resistors R51 and R52.

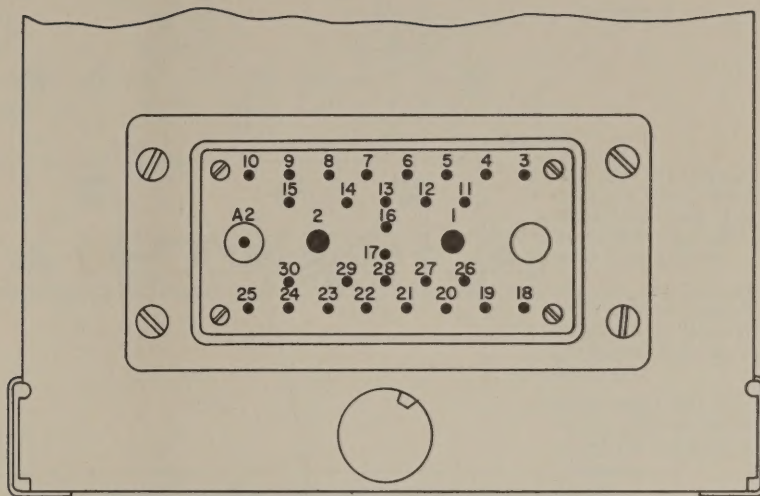
Page 85. Figure 64. Insert figure 64.1 after figure 64.



3



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TERMINAL	RESISTANCE	TERMINAL	RESISTANCE	TERMINAL	RESISTANCE
1	0	11	∞	21	∞
2	∞	12	∞	22	∞
3	∞	13	∞	23	∞
4	∞	14	0	24	∞
5	∞	15	.6	25	∞
6	4	16	∞	26	∞
7	∞	17	1.8 MEG	27	∞
8	140K	18	∞	28	∞
9	1.2 MEG	19	∞	29	∞
10	∞	20	∞	30	∞
				A2	100K

NOTES:

1. RESISTANCE MEASUREMENTS MADE AT CONNECTOR P252 WITH POWER SUPPLY REMOVED FROM THE RECEIVER.
2. ALL RESISTANCE MEASUREMENTS MADE WITH A VTVM BETWEEN GROUND AND TERMINALS SPECIFIED.

TM 5092-601

Figure 45.1. Radio Receiver R-394/U, resistance measurements on main connector P252.

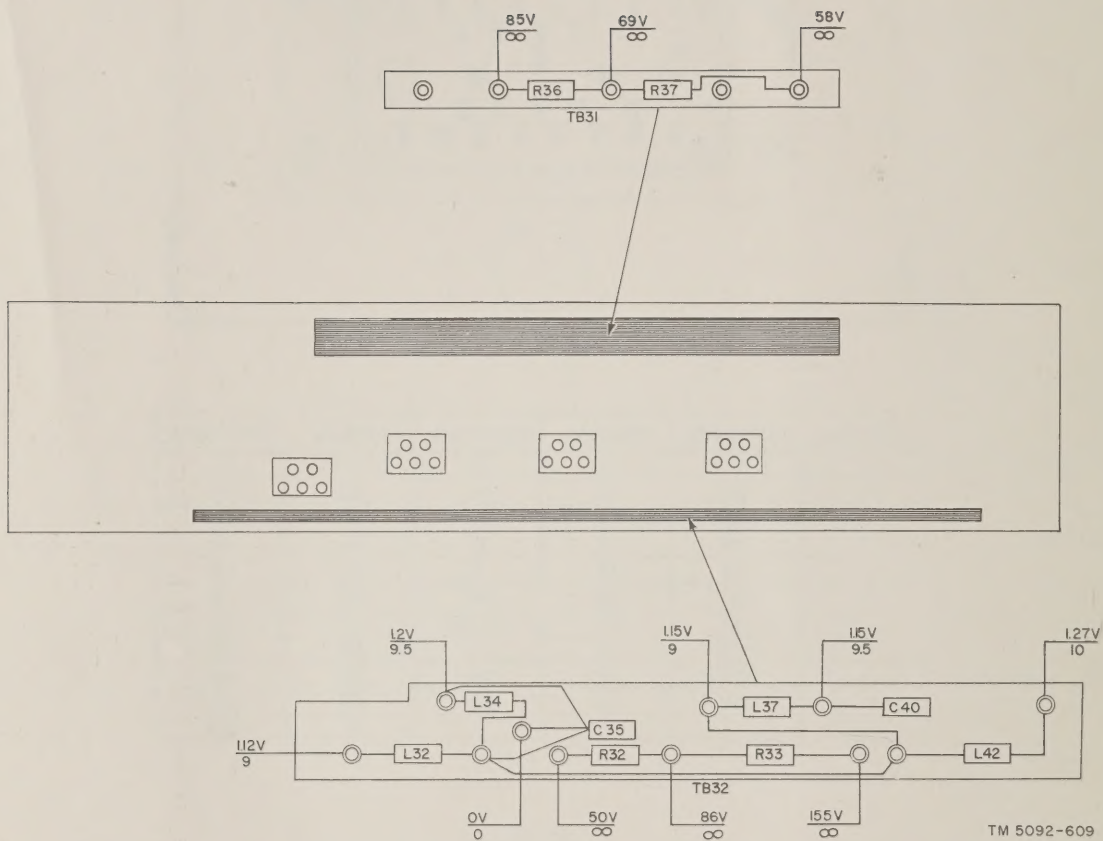


Figure 48.1. Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, terminal board voltage and resistance measurements.

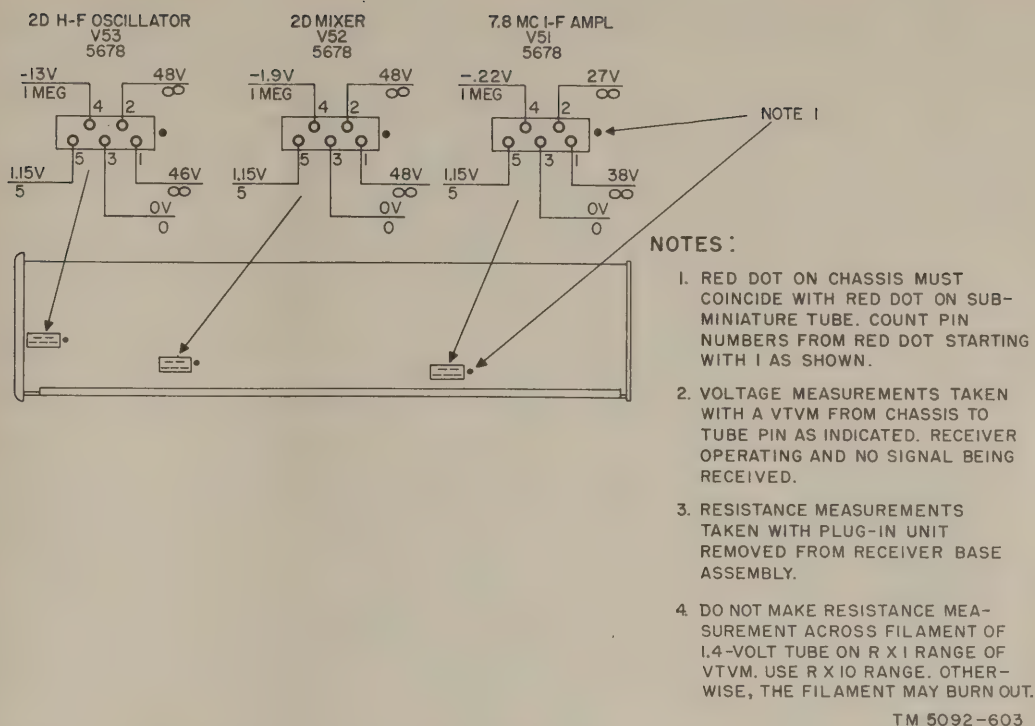


Figure 49.1. Radio Receiver R-394/U, 1ST IF 7.8 MC plug-in unit, tube socket voltage and resistance measurements.

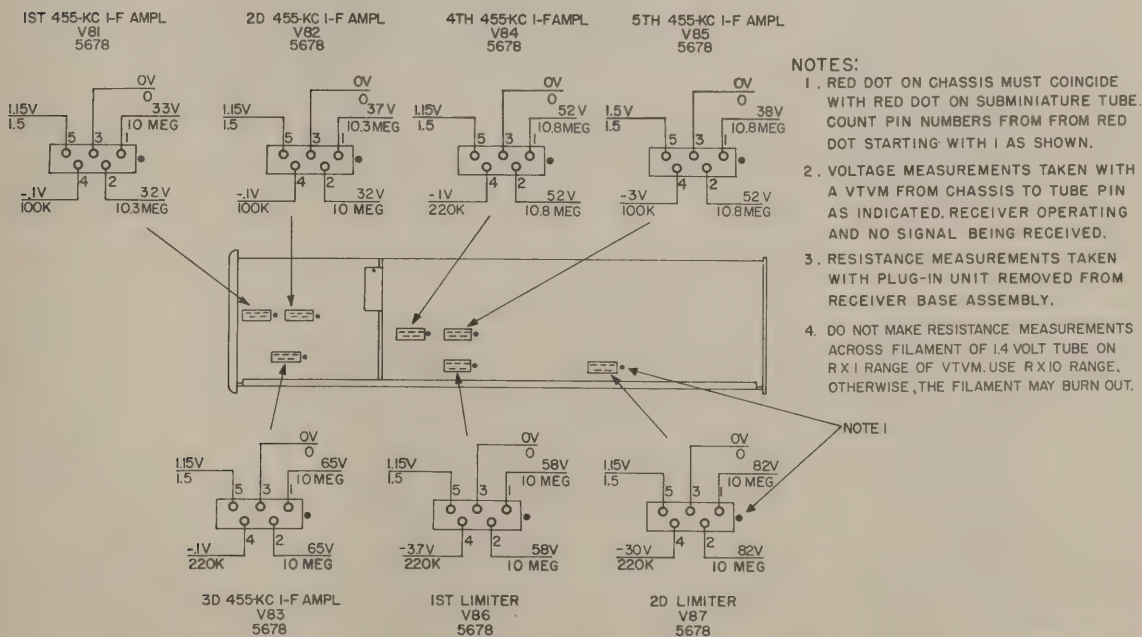


Figure 50.1. Radio Receiver R-394/U, 2ND IF DISCR. plug-in unit, tube sockets voltage and resistance measurements.

1. VOLTAGE MEASUREMENTS TAKEN WITH A VTVM FROM CHASSIS TO TERMINALS AS INDICATED. RECEIVER OPERATING AND NO SIGNAL BEING RECEIVED.
2. RESISTANCE MEASUREMENTS TAKEN WITH PLUG-IN UNIT REMOVED FROM RECEIVER BASE ASSEMBLY.
3. NEGATIVE SIDE OF THE OHMMETER GROUNDING.

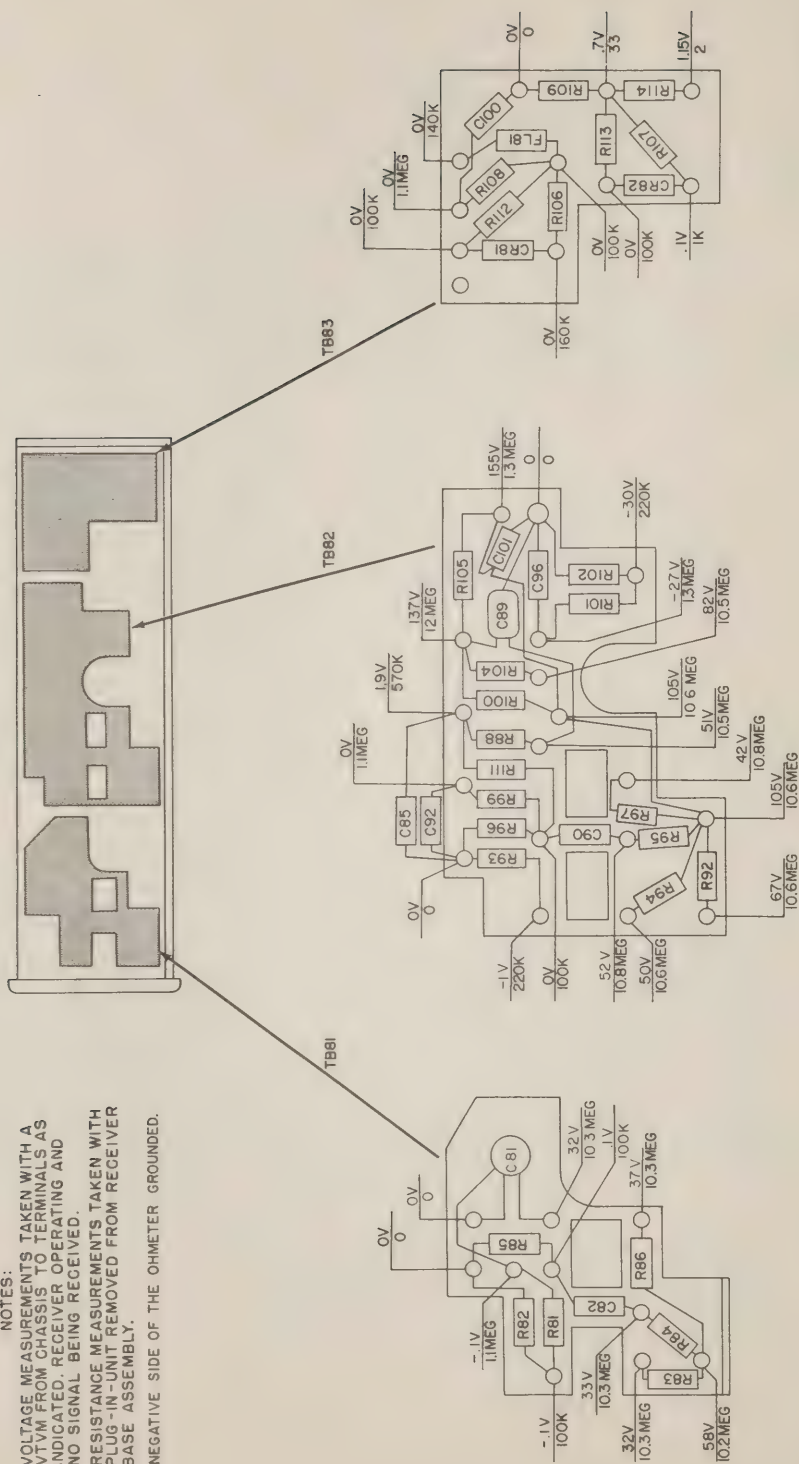


Figure 51.1. Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, terminal board voltage and resistance measurements.

TM 5092-607

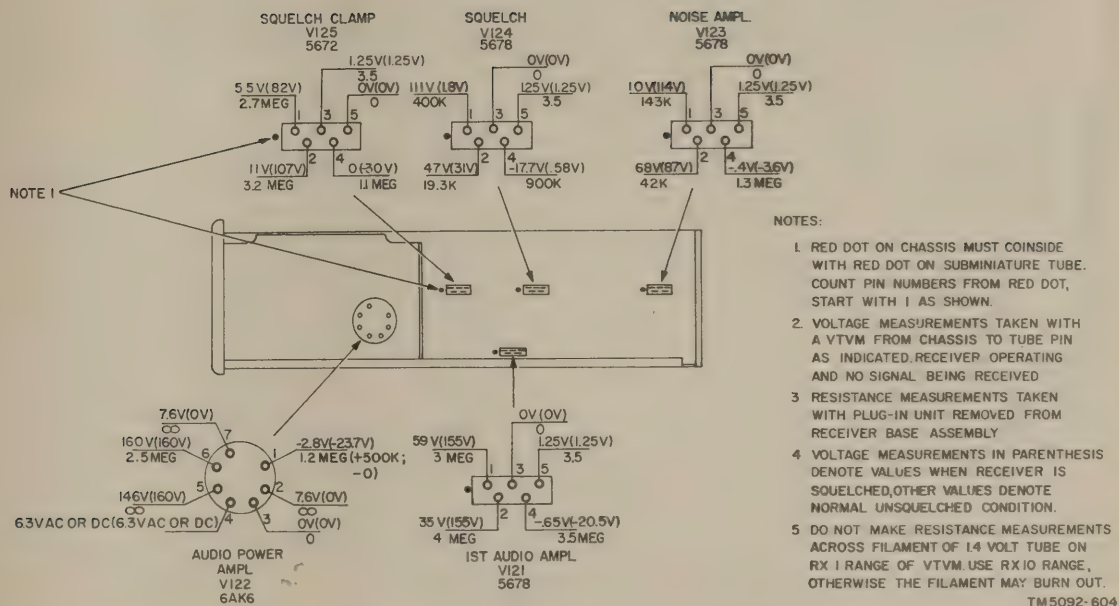
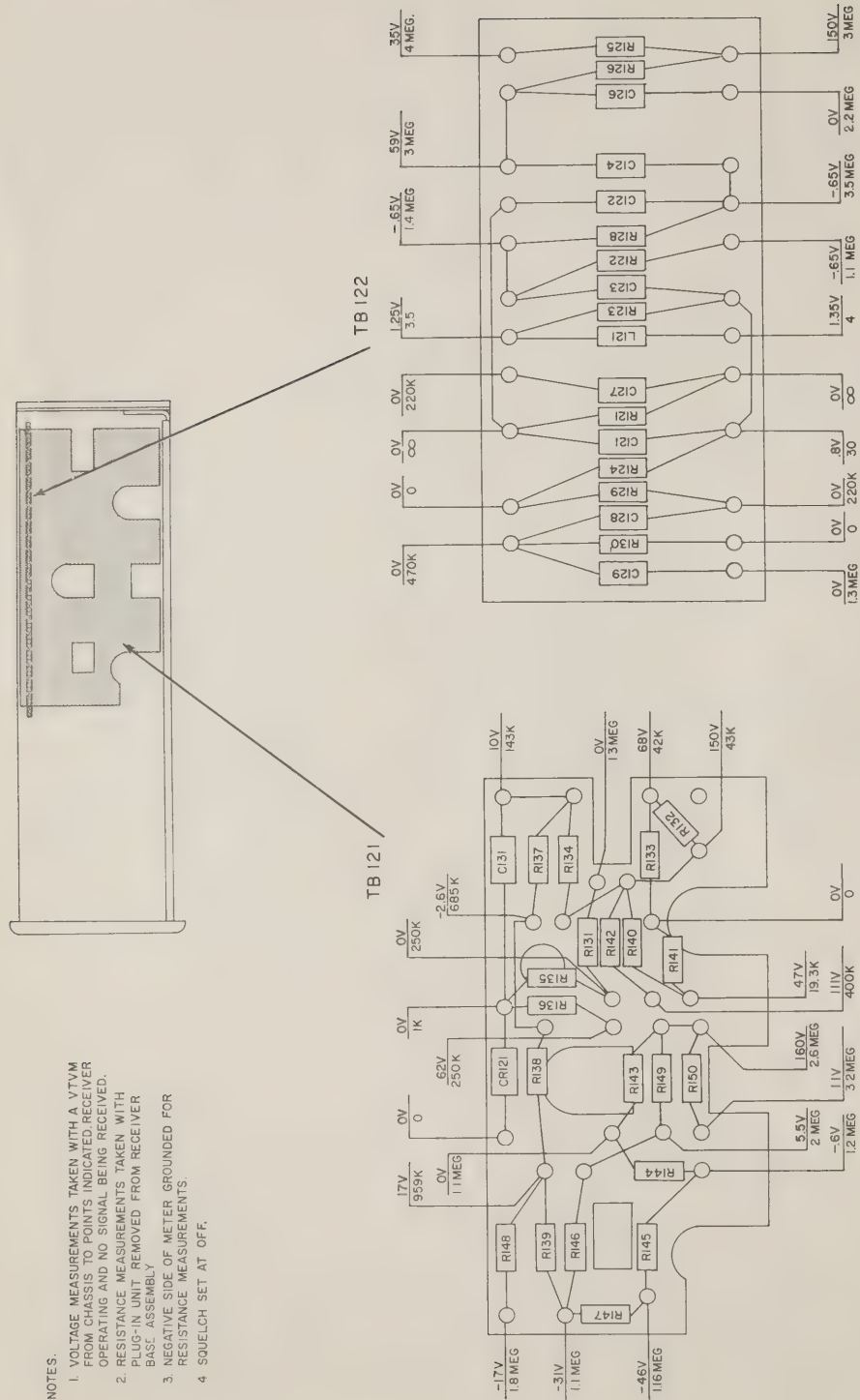
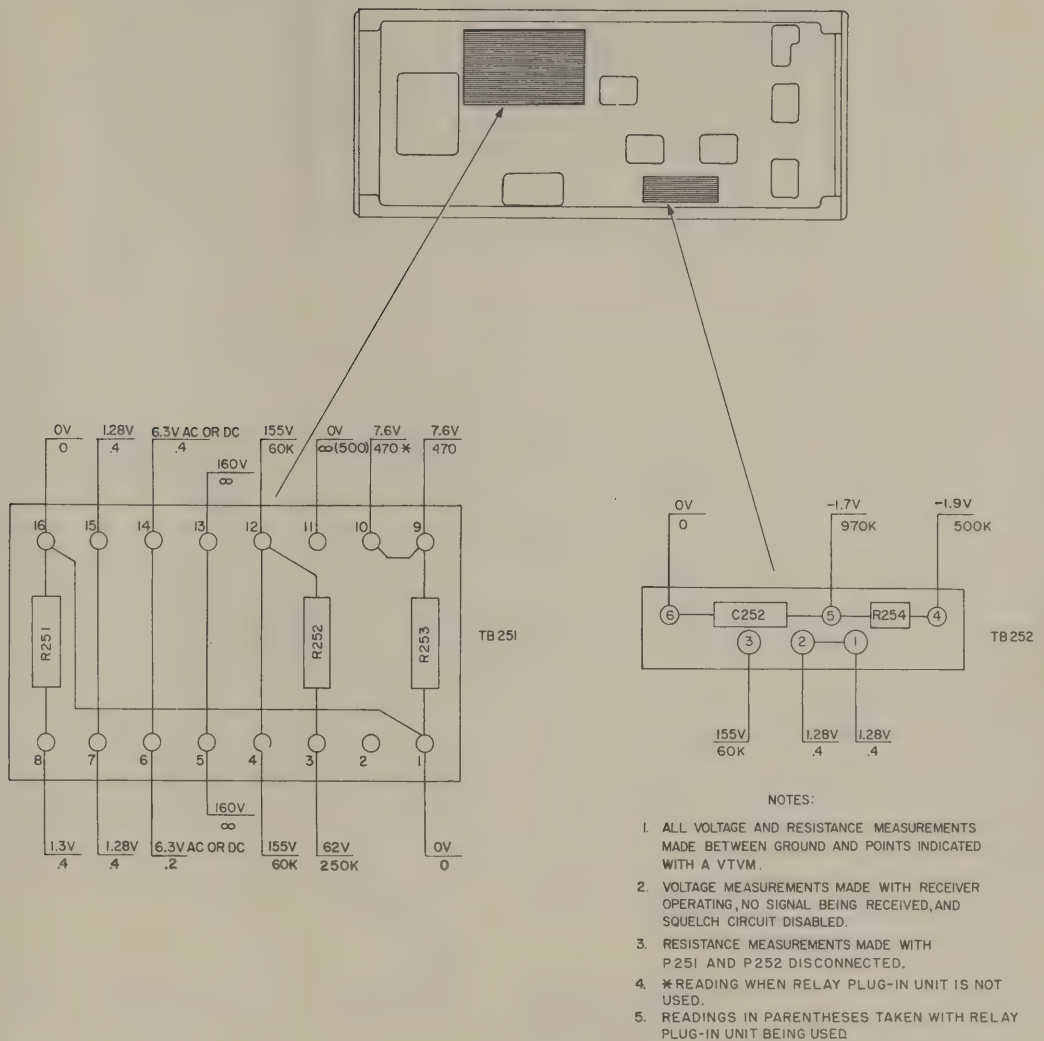


Figure 52.1. Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, tube socket voltage and resistance measurements.



TM 5092-606

Figure 53.1. Radio Receiver R-394/U. AUDIO & SQUELCH plug-in unit, terminal board voltage and resistance measurements.



TM 5092-605

Figure 55.1. Radio Receiver R-394/U, voltage and resistance measurements of base.

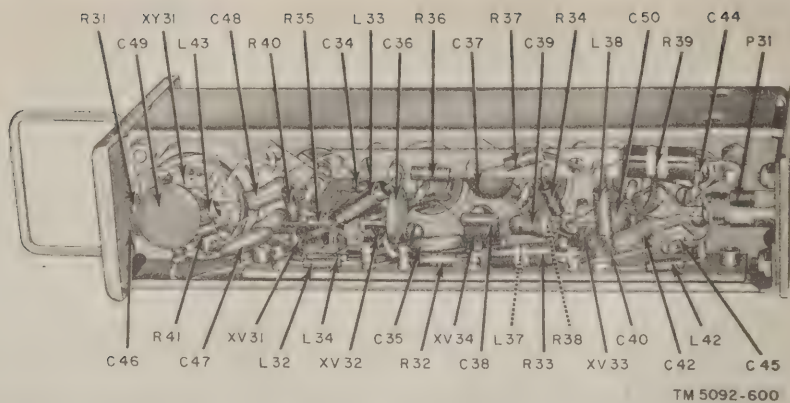


Figure 60.1. Radio Receiver R-394/U, RF AMPL 152-174 MC plug-in unit, bottom chassis view.

Page 85. Figure 65. Interchange R122 and R128.

Page 87. Figure 68. Title. Change the title to read:
Figure 68. Radio Receiver R-394/U, relay
plug-in-unit, (Receiver Subassembly MX-
1547/G) bottom chassis view.

Page 89. Par. 90a. Chart. Signal generator connec-
tion column. Line 1. Add "4" after Pin.

Page 90. Par. 91b(2). Add the following Note.

Note. It is possible to "warp" the crystal to a frequency considerably lower than its natural resonant frequency. Under these conditions some crystals might not oscillate once the receiver is turned off and later turned on. As a precaution against this condition, turn the receiver off and on at least once following the final adjustment of the LOCAL OSC 152-174 MC plug-in unit. If the oscillator fails to function subsequent to this test, it may be necessary to replace the crystal Y31 with one which operates satisfactory.

Page 91. Par. 93. Change subparagraph (3) to read:
"Connect an audio output meter and distortion analyzer to the speaker output terminals (loaded 8 ohms). Change subparagraph (4) to read: Adjust R127 so that the receiver output is .5 watt. The harmonic distortion should not exceed 10 percent. Voltage across 8 ohms for .5 watt is 2 volts."

Page 91. Figure 70. Add the following note. Note:
Thermostat S31 is black.

Page 94. Par. 101c. Line 7. Change "100,000
(100db)" to read: 31,620 (90db).

Page 94. Par. 101c. Line 8. Invert equation.

Page 95. Par. 102e. Invert equation and change
"100,000" to read: 31,620 and "100 db" to
read: 90 db.

Page 95. Par. 103a. Line 7. Change "100" to read:
90.

Page 95. Par. 103b. Lines 4 and 5. Change "100
db" to read: 90 db and "100,000" to read:
31,620.

Page 97. Par. 103c(3). Line 8. Change "attenuated"
to read: increased.

Page 97. Par. 103c(4). Lines 5 and 6. Change "100
db" to read: 90 db and "100,000" to read:
31,620.

Page 97. Par. 104b(7). Change first sentence after
the colon (:) to read: Squelch sensitivity
(db) = value from step (4) (db) minus value from
step (6)(db).

Page 97. Par. 105b(4). Lines 5 and 6. Change
"100,000" to read: 31,620 and "100 db" to
read: 90 db.

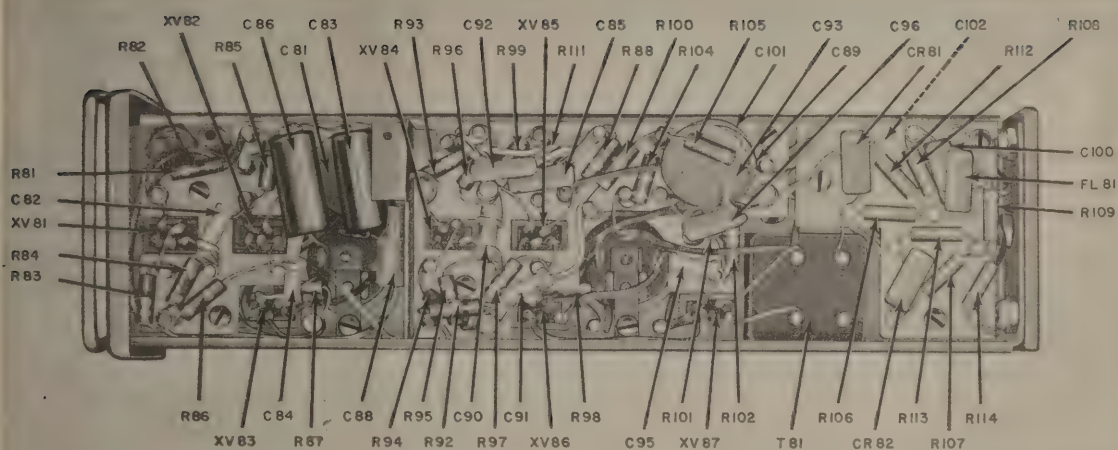
Page 106. APP. II. Par. 2. Make the following
changes.

Item C1, C67. Description Column. Line 1.
Change "5 uuf .25" to read: 5 uuf $\pm$.25.

Item C2, * * *. Description Column. Line 1.
Change "39 uuf" to read: 36 uuf.

Item C5, C8. Description column. Line 1.
Change "6 uuf .25" to read: 6 uuf $\pm$.25.

Item C12 thru C18, C28. Ref. symbol column.
Change "C28" to read: C32.



TM 5092-611

Figure 64.1. Radio Receiver R-394/U, 1ST IF 7.8 MC plug-in unit, bottom view.

Change the bottom of the page, beginning with C26 *** to read:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C36, C37, C71	CAPACITOR, fixed: ceramic dielectric; 5000 uuf +100 -0%; 500 vdcw.	C36: V31 plate circuit r-f bypass. C37: V32 screen grid bypass. C71: B+ bypass.	3DA5-219
C19, C22, C24, C25, C26, C40, C50	CAPACITOR, fixed: ceramic dielectric; 5000 uuf +100 -0%; 500 vdcw.	C19: V3 screen grid bypass. C22: V3 filament bypass. C24: V1 screen grid bypass. C25: V2 screen grid bypass. C26: V2 filament bypass. C40: V33 cathode filament bypass. C50: V33 screen grid bypass.	

Page 107. APP. II. Par. 2. Make the following changes:

Change the page, between items C27 and C34 * * *, to read:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C46	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA REF DWG GROUP 1; 10 uuf +0.25 uuf; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	V31 control grid bypass.	3D9010-224
C35, C47, C55, C70, C75	CAPACITOR, fixed: ceramic dielectric; 2 sect., 5000 uuf +100 -0%; 500 vdcw, ea. sect.	C35: Filament bypass. C47: V31 screen grid and filament r-f bypass. C55: V51 screen grid bypass. C70: L56 and L57 bypass. C75: B+ bypass.	3DA5-253

Add the following at the bottom of the page.

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C48	CAPACITOR, fixed: ceramic dielectric; 47 uuf; $\pm 10\%$; 500 vdcw; 150 uuf per uf per deg C, ± 30 uuf tolerance, Motorola Inc. Part No. 921R731.	D-c blocking for crystal Y31.	

Page 108. APP. II. Par. 2. Make the following changes.

Item C20, C58. Stock No. column. Change 3D9000.35 to read: 3D9000.35-1.

Change the bottom of the page, after item C66, to read:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C63, C85, C92, C96	CAPACITOR, fixed: ceramic dielectric; 10,000 uuf -20% +80%; 150 vdcw.	C63: RF test point bypass. C85: AGC line bypass. C92: 2ND IF test point bypass. C96: Test point bypass.	3DA10-594
C73	CAPACITOR, fixed: ceramic dielectric; 8 uuf $\pm$.25 uuf; case .500 in. lg. max x .250 in. dia max, Motorola part No. 921R796.	V53 plate to grid feedback.	
C76	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 1.5 uuf $\pm$ 0.25 uuf 500 vdcw; .500 in. lg max x .250 in. dia max; Motorola part No. 921R746.	V52 control grid coupling from second h-f oscillator.	
C82, C90	CAPACITOR, fixed: ceramic dielectric; case style No. 1 MBCA ref dwg group 1; 47 uuf $\pm$ 5%; 500 vdcw; 330 uuf per uf per deg C negative, +500 uuf tolerance.	C82: V81-V82 coupling. C90: V84 to V85 coupling.	3D9047-78
C84, C88, C91, C95	CAPACITOR, fixed: ceramic dielectric; case style No. 1 MBCA ref dwg group 1; 24 uuf $\pm$ 5%; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	C84: V82-V83 coupling. C88: V83-V84 coupling. C91: V85-V86 coupling. C95: V86-V87 coupling.	3D9024-67
C125, C132	CAPACITOR, fixed: paper dielectric; case style No. 1, MBCA ref dwg group 1; 24 uuf $\pm$ 5%; 500 vdcw; 150 uuf per deg C negative, +60 uuf tolerance.	C125: V121 screen grid bypass. C132: V124 control grid bypass.	3DA22-28

Page 109. APP. II. Par. 2. Make the following changes:

Item C93, C100, C102. Ref. symbol column. Change to read: C49, C93, C100, C102, and in function column above C93, add C49: Thermostat S31 contact bypass.

Item C130. Stock No. column. Add 3DA22-29.

Item L2, * * *. Description column. Line 1. Change "CHOKE, RF: no current rating; plate lead r-f" to read: CHOKE, RF: no current rating; 4 uh; plate lead r-f

Page 110. APP. II. Par. 2. Make the following changes:

Item L5, L10, L14, L34. Ref. symbol and function column. Delete L14, and in description

column change "COIL, RF: 100 ma" to read: COIL, RF: 2.3 uh, 100 ma.

Item L32, L37. Description column. Line 1. Change "COIL, RF: 100 ma" to read: COIL, RF: 1.17 uh, 100 ma.

Item L33. Description column. Line 1. Change "COIL, RF: 160 ma" to read: COIL, RF: 5 uh, 160 ma.

Item L121. Description column. Line 1. Change "COIL, RF: 250 ma" to read: COIL, RF: 2.75 uh, 250 ma.

Item H265, H266. Ref. symbol column. Delete H266.

Add the following between item H265 and E10, * * *:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
H266	CLAMP, electrical: 1-3/32 in. lg x 1/2 in. wd x 5/8 in. h; Motorola part No. 242T1073.	Used as cable clamp.	

Item L42. Delete.

Page 111. APP. II. Par. 2. Make the following changes: Change the top of the page down to item Z1 to read:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
L42, L56, L57	COIL, RF: 6.5 uh at 7.9 mc; .06 ohms d-c resistance: 500 ma; tuning not provided.	L42: Filament chokes for V31, V32 and V33. L56, L57: V51 filament choke.	3C362-100
L58	COIL, RF: 25 uh at 2.5 mc; 1.75 ohms d-c resistance.	V53 plate supply r-f choke.	
L43	COIL, RF: 9.5 uh.	Part of loading circuit for crystal Y31.	

Item Z2, Z4. Description column. Add at the end of the description; contains a capacitor.

Item Z3, Z5. Description column. Add at the end of the description; contains 2 capacitors.

Item Z6. Description column. Add at the end of the description; contains 4 capacitors.

Item Z51. Description column. Add at the end of the description; contains 4 capacitors.

Item Z52, Z53, Z54. Description column. Add at the end of the description, contains 2 capacitors.

Item Z55. Description column. Line 1. Change "COIL, RF: 5 uh" to read: 1.9 uh, and at the end of the description add: contains 3 capacitors and 1 resistor.

Item Z81. Description column. Add at the end of the description; contains 1 capacitor and 1 resistor.

Page 113. APP. II. Par. 2. Make the following change:

Item CR81, CR82, CR121. Stock No. column. Change "2JIN63" to read: 2Z3565-17.

Page 114. APP. II. Par. 2. Make the following change.

Item H288. Description column. Line 1. Change "HOLDER, spring" to read: SPRING, latch:

Page 115. APP. II. Par. 2. Make the following changes:

Item A82: Stock no. column. Change "2Z7090-337" to read: 2Z7090.354.

Last item on page. Add Z56 in the ref. symbol column.

Page 118. APP. II. Par. 2. Make the following changes:

Item R126: Function column. Change "R126: V121 de-emphasis resistor" to read: R126: V121 plate load.

Item R33. Function column. Change "VR31" to read: VR34.

Change item R36 to read:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R36, R41, R105	RESISTOR, fixed: comp; 2200 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation, JAN Spec. Type RC20BF222K.	R36: V31 plate voltage dropping. R41: Part of loading circuit for crystal Y31. R105: B+ filter in parallel with C89B and C101B.	3RC20BF222K

Item 56, R60, * * *. Ref. symbol and function column.

Delete R56, and in function column, change "R60: V53 B+ coupling" to read: R60: V52 and V53 B+ coupling.

Add at the bottom of the page:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R110	RESISTOR, fixed: comp. 100,000 ohms $\pm 5\%$, 1/2 w power dissipation; JAN spec No. JAN-R-11, spec type No. RC20BF104J; Motorola part No. 906R535.	Part of Z81 network.	3RC20BF104J

Page 119. APP. II. Par. 2. Make the following change.

Item R111, * * *. Stock No. column. Add: 3RC20BF474K.

Page 120. APP. II. Par. 2. Make the following changes.

Item R144. Stock no. column. Add: 3RC20BF153K.

Change R251 to read:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R251	RESISTOR, fixed: comp; 22 ohms $\pm 10\%$; not tapped; 2 w power dissipation; JAN spec type RC42BF220K.	Filament shunt.	3RC42BF220K

Item R253, R271. Ref. symbol and function column. Delete R271.

Item XV2 * * *. Description column. Add after the description: Motorola Part No. 209B115.

Page 122. APP. II. Par. 2. Make the following change.

Item H272 thru H277. Stock no. column. Change "6Z8585-8" to read: 6Z8585-14.

Page 124. APP. II. Par. 2. Add after T81:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
O 251	TOOL, alinement: nylon body; 4 in. lg x 1/4 in. dia; Motorola part No. 266A1001.	Alinement tool.	6Q336-2

Page 127. Figure 76. Insert figure 76.1 after figure 76.

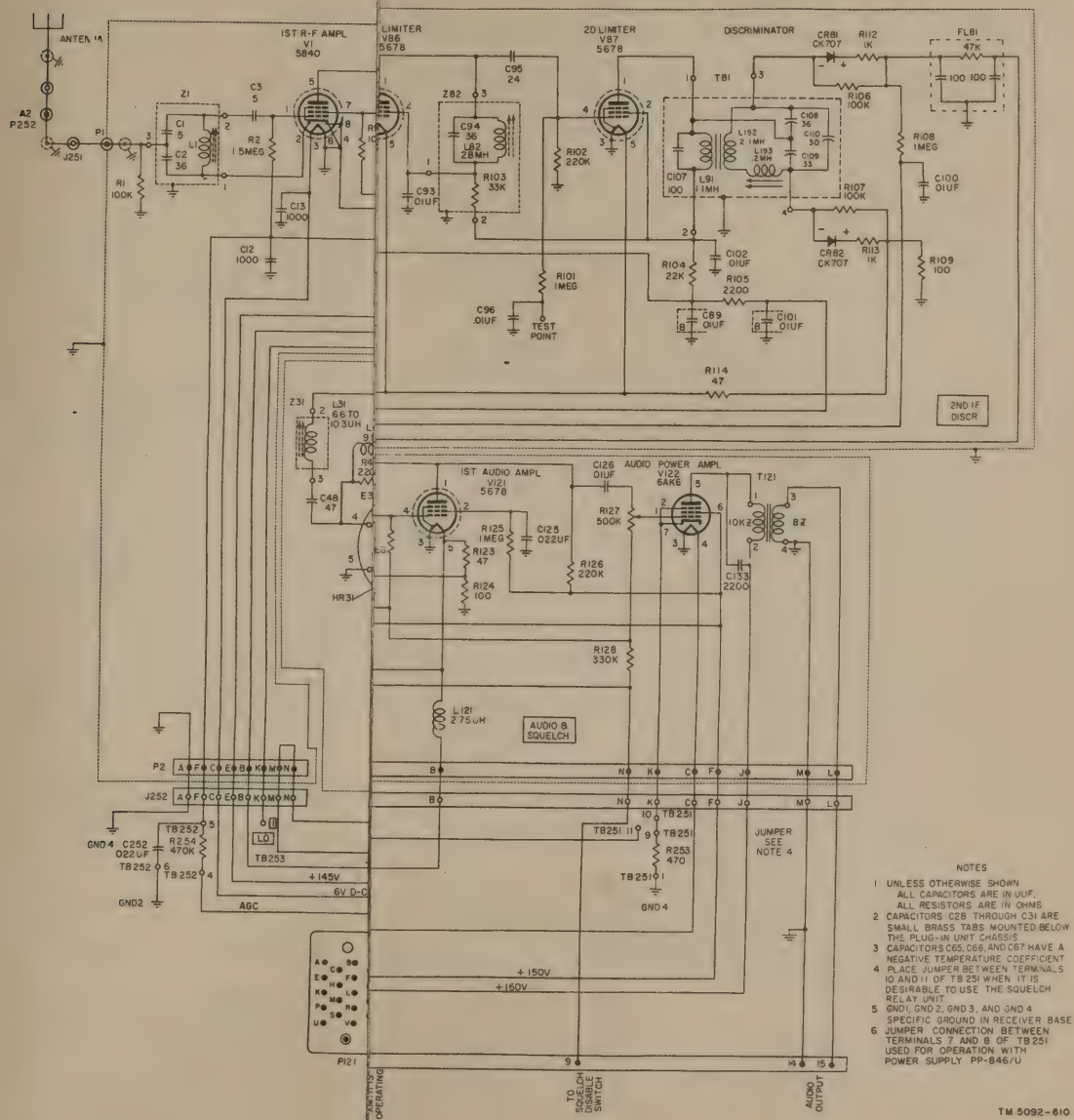


Figure 76.1. Radio Receiver R-394/U, schematic diagram.

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R36, R41, R105	RESISTOR, fixed: comp; 2200 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation, JAN Spec. Type RC20BF222K.	R36: V31 plate voltage dropping. R41: Part of loading circuit for crystal Y31. R105: B+ filter in parallel with C89B and C101B.	3RC20BF222K

Item 56, R60, * * *. Ref. symbol and function column.

Delete R56, and in function column, change "R60: V53 B+ coupling" to read: R60: V52 and V53 B+ coupling.

Add at the bottom of the page:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R110	RESISTOR, fixed: comp. 100,000 ohms $\pm 5\%$, 1/2 w power dissipation; JAN spec No. JAN-R-11, spec type No. RC20BF104J; Motorola part No. 906R535.	Part of Z81 network.	3RC20BF104J

Page 119. APP. II. Par. 2. Make the following change.

Item R111, * * *. Stock No. column. Add: 3RC20BF474K.

Page 120. APP. II. Par. 2. Make the following changes.

Item R144. Stock no. column. Add: 3RC20BF153K.

Change R251 to read:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R251	RESISTOR, fixed: comp; 22 ohms $\pm 10\%$; not tapped; 2 w power dissipation; JAN spec type RC42BF220K.	Filament shunt.	3RC42BF220K

Item R253, R271. Ref. symbol and function column. Delete R271.

Item XV2 * * *. Description column. Add after the description: Motorola Part No. 209B115.

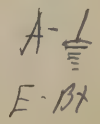
Page 122. APP. II. Par. 2. Make the following change.

Item H272 thru H277. Stock no. column. Change "6Z8585-8" to read: 6Z8585-14.

Page 124. APP. II. Par. 2. Add after T81:

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
O 251	TOOL, alinement; nylon body; 4 in. lg x 1/4 in. dia; Motorola part No. 266A1001.	Alinement tool.	6Q336-2

Page 127. Figure 76. Insert figure 76.1 after figure 76.



TM 5092-610

Figure 76.1. Radio Receiver R-394/U, schematic diagram.

**ADDENDA NO. 4 TO
INSTRUCTION BOOK
FOR
RADIO RECEIVER R-394/U**

The following information, published on Order No. 11661-Phila-52-93, provides information to be added to the instruction book in addition to that provided by Addenda No. 3. The changes in this addenda pertain only to the AUDIO AND SQUELCH subassemblies with serial numbers 1300 and higher. All Radio Receiver R-394/U units with serial numbers 960 and higher will be shipped from the factory with these modified subassemblies installed.

Personnel using this equipment and having custody of this addenda will enter suitable notations beside each affected paragraph and figure in the instruction book to indicate the presence of this supplementary information.

Page 45. Fig. 32. Make the following changes in figure 32:

Delete resistor R150 and lead connecting to terminal 2 of V125.

Connect terminal 2 of V125 to terminal 2 of V124.

Change the value of capacitor C129 from 24 uuf to 47 uuf.

Make the following changes in resistor values:

Change R131 from 1 MEG to 470K.

Change R132 from 47K to 68K.

Change R136 from 220K to 330K.

Change R137 from 470K to 560K.

Change R142 from 470K to 330K.

Change R147 from 220K to 120K.

Change R149 from 470K to 220K.

Delete resistor R150 and lead connecting to terminal 2 of V125.

Connect terminal 2 of V125 to terminal 2 of V124.

Make the following changes in resistor values:

Change R131 from 1 MEG to 470K.

Change R132 from 47K to 68K.

Change R136 from 220K to 330K.

Change R137 from 470K to 560K.

Change R142 from 470K to 330K.

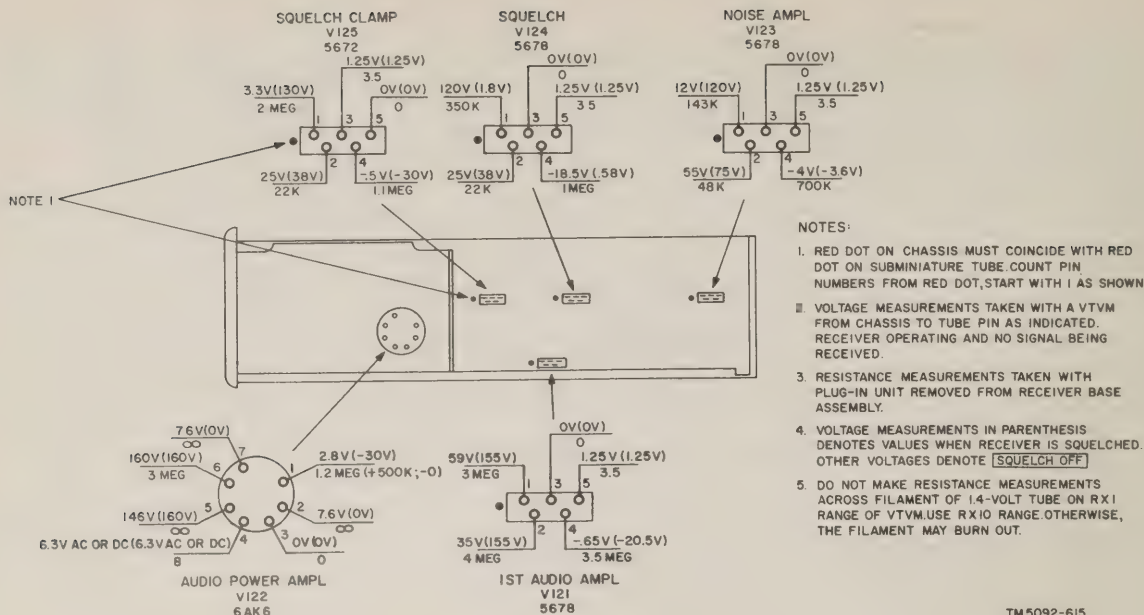
Change R147 from 220K to 120K.

Change R149 from 470K to 220K.

Page 72. Fig. 52.1. Add the following to the caption: (*for plug-in units with serial numbers from 1 through 1299*).

Page 61. Fig. 43. Make the following changes in figure 43:

Page 72. Fig. 52.1. Insert figure 52.2 after figure 52.1.



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Figure 52.2. Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, tube socket voltage and resistance measurements (for plug-in units with serial numbers 1300 and higher.)

Page 73. Fig. 53.1. Add the following to the caption: (for plug-in units with serial numbers from 1 through 1299).

Page 73. Fig. 53.1. Insert figure 53.2 after figure 53.1.

Page 86. Fig. 66. Add the following note to the figure:

Note. For all plug-in units except those with serial numbers from 1 through 1299, R150 is deleted.

Page 109. App II. Par. 2. Make the following changes:

Delete C129 and all information pertaining to it.

In the "Ref symbol" column, change "C128" to read: C128, C129.

In the "Function of part" column, change the function to read:

C128: V123 input coupling.

C129: V123 input coupling.

Page 116. App. II. Par. 2.

In the "Ref symbol" column, delete R134.

In the "Function of part" column, delete information that pertains to R134.

Page 117. App. II. Par. 2.

In the "Ref symbol" column, delete R131 and R134.

In the "Function of part" column, delete information that pertains to R131 and R146.

Page 118. App. II. Par. 2.

In the "Ref symbol" column, delete R136, R147, and R133.

In the "Function of part" column, delete information that pertains to R136, R147, and R133.

Page 119. App. II. Par. 2.

In the "Ref symbol" column, delete R132, R137, R139, R142, and R149.

In the "Function of part" column, delete information that pertains to R132, R137, R139, R142, and R149.

3. SQUELCH DISABLED (SQUELCH OFF)
FOR VOLTAGE READINGS.



Figure 53.2. Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, terminal board voltage and resistance measurements (for plug-in units with serial numbers 1800 and higher)

Page 119. App. II. Par. 2.

In the "Ref symbol" column, add R131 after item R254.

In the "Function of part" column, add the following: R131: V123 grid bias.

Page 120. App. II. Par. 2.

In the "Ref symbol" column, delete R138.

In the "Function of part" column, delete information that pertains to R138.

Page 120. App II. Par. 2. Add the following items after "R127":

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R132, R133	RESISTOR, fixed: comp; 68,000 ohms $\pm 5\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN spec type RC20BF683J.	R132: V123 screen grid dropping. R133: Part of voltage divider for screen grid of V123.	3RC20BF683J
R134	RESISTOR, fixed: comp; 100,000 ohms $\pm 5\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN type No. RC20BF104J.	V123 plate load.	3RC20BF104J
R136, R142	RESISTOR, fixed: comp; 330,000 ohms $\pm 10\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN spec type No. RC20BF334K.	R136: Squelch control voltage divider R142: V124 plate load.	3RC20BF334K
R137	RESISTOR, fixed: comp; 560,000 ohms $\pm 5\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN spec type No. RC20BF564J.	V123 dc coupling.	3RC20BF564J
R138	RESISTOR, fixed: comp; 680,000 ohms $\pm 5\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN type No. RC20BF684J.	Part of voltage divider to grid of V124.	3RC20BF684J
R139	RESISTOR, fixed: comp; 470,000 ohms $\pm 5\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN spec type No. RC20BF474J.	V124 dc coupling.	3RC20BF474J
R146	RESISTOR, fixed: comp; 1 megohm $\pm 5\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN spec type No. RC20BF105J.	V125 dc coupling.	3RC20BF105J
R147	RESISTOR, fixed: comp; 120,000 ohms $\pm 5\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN spec type No. RC20BF124J.	V125 voltage divider.	3RC20BF124J
R149	RESISTOR, fixed: comp; 220,000 ohms $\pm 10\%$; not tapped; $\frac{1}{2}$ w power dissipation; JAN spec type No. RC20BF224K.	V125 plate load.	3RC20BF224K

Page 127. Fig. 76. Make the following changes in figure 76:

Delete resistor R150 and lead connecting to terminal 2 of V125.

Connect terminal 2 of V125 to terminal 2 of V124.

Change the value of capacitor C129 from 24 uuf to 47 uuf.

Make the following changes in resistor values:

Change R131 from 1 MEG to 470K.

Change R132 from 47K to 68K.

Change R136 from 220K to 330K.

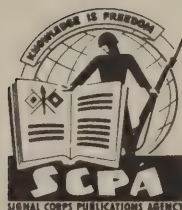
Change R137 from 470K to 560K.

Change R142 from 470K to 330K.

Change R147 from 220K to 120K.

Change R149 from 470K to 220K.

INSTRUCTION BOOK FOR RADIO RECEIVER R-394/U



**MANUFACTURED BY
MOTOROLA, INC.
CHICAGO, ILLINOIS
ORDER NO. 11661-PHILA-52-93
17 MARCH 1953**

WARNING

HIGH VOLTAGE

is used in the operation of
this equipment

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

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ARTIFICIAL RESPIRATION

GENERAL PRINCIPLES

1. Seconds count! Begin at once! Don't take time to move the victim unless you must. Don't loosen clothes, apply stimulants or try to warm the victim. Start resuscitation! Get air in the lungs! You may save a life!

2. Place the victim's body in a prone position, so that any fluids will drain from the respiratory passages. The head should be extended and turned sideward *never flexed forward*; the chin shouldn't sag, since obstruction of the respiratory passages may occur.

3. Remove any froth or debris from the mouth with your fingers. Draw the victim's tongue forward.

4. Begin artificial respiration. Continue it rhythmically and without any interruption until natural breathing starts or the victim is pronounced dead. Try to keep the rhythm smooth. Split-second timing is not absolutely essential.

5. When the victim starts breathing, or when additional help is available loosen the clothing; remove it, if it's wet; keep the victim warm. Shock should receive adequate attention. Don't interrupt the rhythmical artificial technique for these measures. Do them only when you have help or when natural breathing has started.

6. When the victim is breathing, adjust your timing to assist him. Don't fight his efforts to breathe. Synchronize your efforts with his. After resuscitation, keep him lying down until seen by a physician or until recovery seems certain.

7. Don't wait for mechanical resuscitation! If an approved model is available, use it, but, since mechanical resuscitators are only slightly more effective than properly performed "push-pull" manual technique, *never* delay manual resuscitation for it.

BACK-PRESSURE ARM LIFT METHOD

1. *Position of Victim.* Place the victim in the prone (face-down) position. Bend his elbows; place one hand upon the other. Turn his face to one side, placing his cheek upon his hands.

2. *Position of Operator.* Kneel on your left or right knee, at the victim's head, facing him. Your knee

should be at the side of the victim's head close to his forearm, your foot should be near his elbow. Kneel on both knees if you find it more comfortable, with one knee on each side of the head. Place your hands on the flat of the victim's back so that their heels are just below the lower tip of his shoulder blades. With the tip of your thumbs touching spread your fingers downward and outward. (See A)

3. *Compression Phase.* Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert a slow, steady, even, downward pressure upon your hands. This forces air out of the lungs. Keep your elbows straight and press almost directly downward on the back. (See B)

4. *Expansion Phase.* Release the pressure, avoid any finish thrust, and commence to rock backward slowly. Place your arms upon the victim's arms just above the elbows, and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders.

Don't bend your elbows. As you rock backward, the victim's arms will be drawn toward you. (The arm lift expands the chest by pulling on the chest muscles, arching the back and relieving the weight on the chest.) Drop the arms gently to the ground or floor. This completes the cycle. (See C and D). Now, repeat the cycle.

5. *Cycle Timing and Rhythm.* Repeat the cycle 10 to 12 times per minute. Use a steady uniform rate of Press, Release, Lift, Release. Longer counts of about equal length should be given to the "Press" and "Lift" steps of the compression and expansion phases. Make the "Release" periods of minimum duration.

6. *Changing Position or Operator.*

(a) Remember that you can use either or both knees or can shift knees during the procedure, provided you don't break the rhythm. Observe how you rock forward with the back-pressure and backward with the arm-lift. The rocking motion helps to sustain the rhythm and adds to the ease of operation.

(b) If you tire and another person is available, you can "take turns." Be careful not to break the rhythm in changing. Move to one side and let your replacement come in from the other side. Your replacement begins the "Press-Release" after one of the "Lift-Release" phases, as you move away.

TM AR-3



A Position of operator and victim



B Compression phase

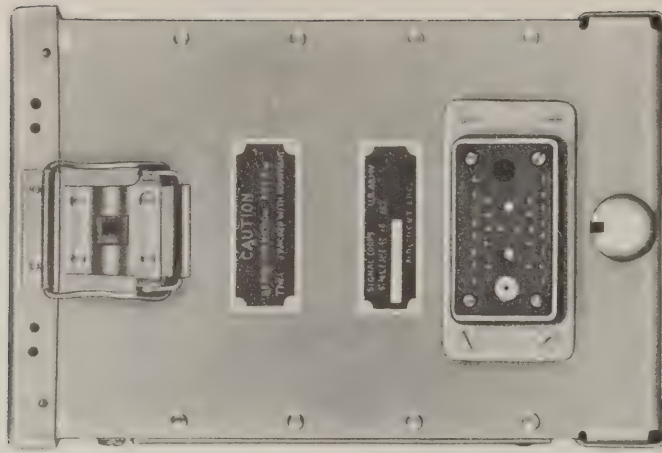
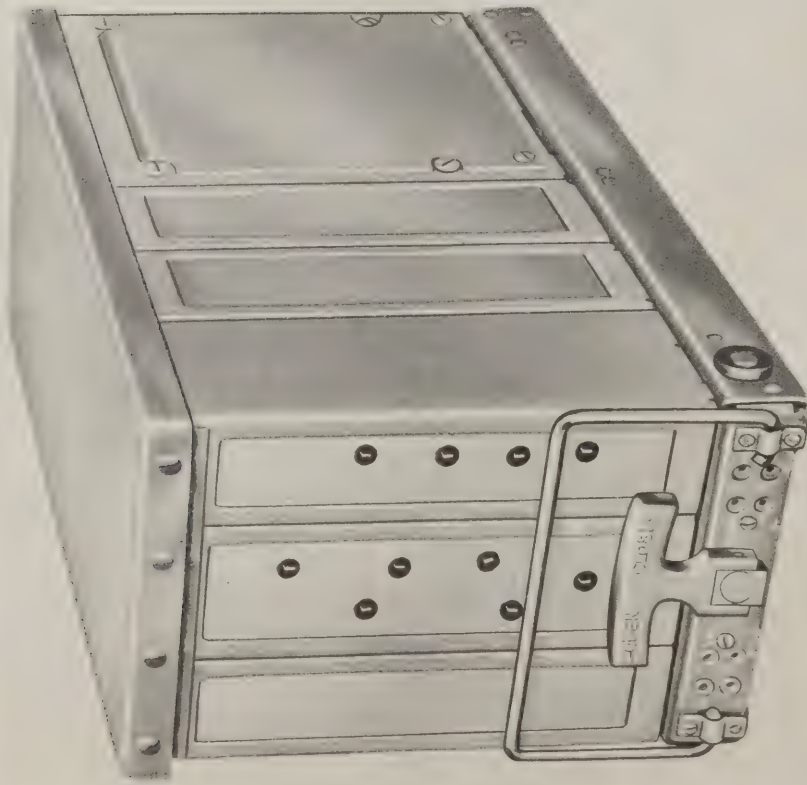


C Expansion phase (arm lift)



D Expansion phase (arm release)

TMAR-4



TM 5092-527

Figure 1. Radio Receiver R-394/U, front and rear.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This instruction book contains the necessary instructions for the installation, operation, maintenance, and repair of Radio Receiver R-394/U (fig. 1). There are also two appendixes consisting of a list of references and an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. DD Form 6, Report of Damaged or Improper

Shipment, will be filled out and forwarded as prescribed in SR 745-45-5.

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. DA AGO Form 11-239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 16).

d. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Radio Receiver R-394/U is a 22-tube double conversion superheterodyne receiver. It operates in the frequency range of 152 to 174 mc (megacycles) at a crystal controlled preset frequency. The design is such that it must be used with additional equipment because it does not have controls or a reproduction unit for converting the audio output signals to sound waves.

a. The receiver is used for detecting f-m (frequency-modulated) signals and converting them to useable audio signals. A relay can be added to the receiver for controlling the operation of a radio transmitter, such as Radio Transmitter T-416/GR. Spare relay contacts are available on the relay to control other equipment if desired.

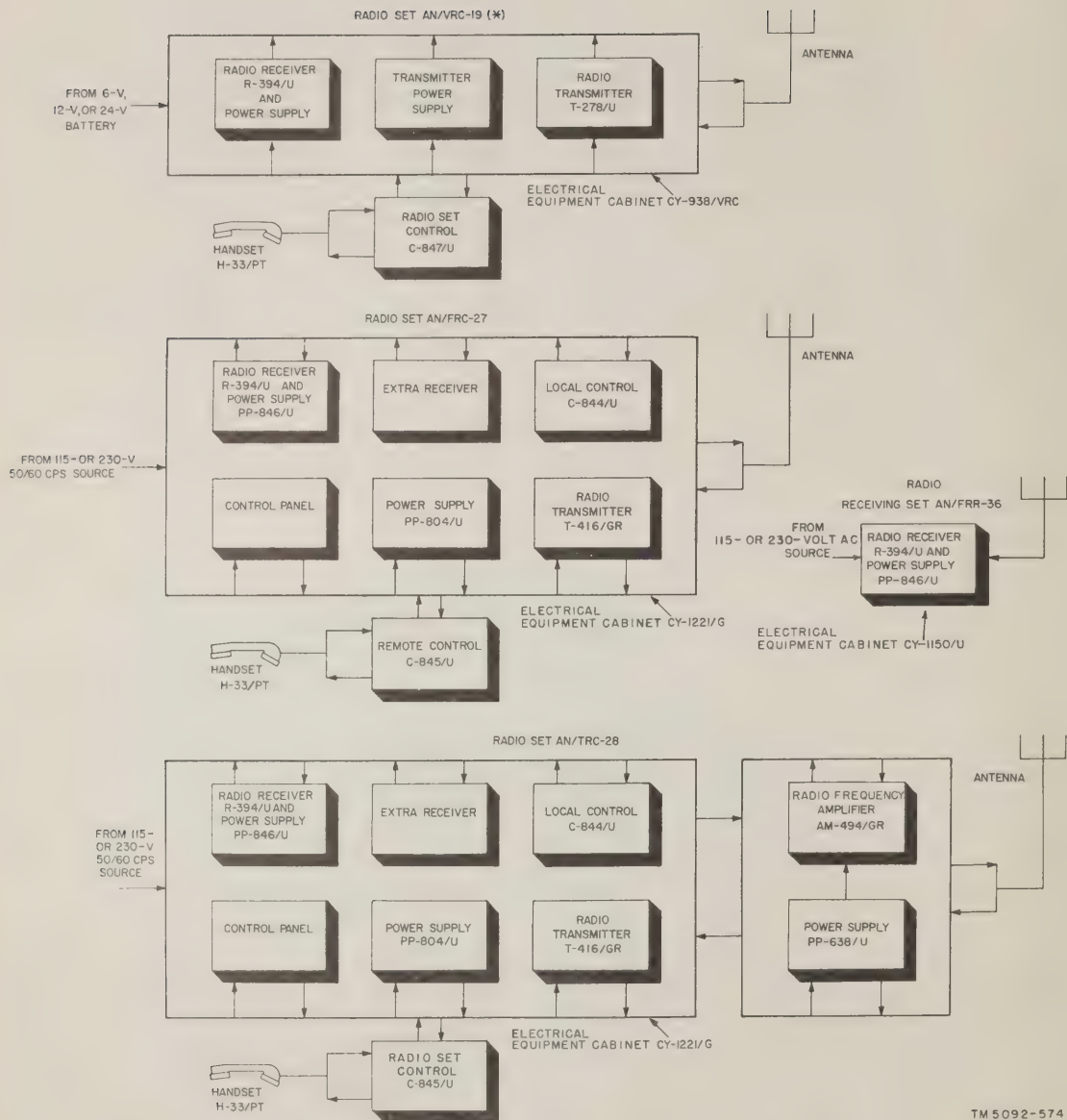
b. Physically, the receiver is a compact unit which is built to withstand shocks encountered in mobile use. Operation is simple and operational maintenance is rapid and relatively easy because plug-in type assemblies are used for all the stages. Ordinarily, a defective receiver can be repaired merely by changing one of the plug-in units. The construction is standard for the different radio sets of the group with which it is to be used. This enables interchangeability with other receivers.

c. Automatic gain control is incorporated to compensate for variations in signal strength as well as to provide more uniform gain among different units of this receiver. In addition to the ordinary circuits of the receiver a squelch circuit is provided to silence the receiver when no signal is being received. A squelch relay may also be used to control a radio transmitter or a call device.

4. System Application

a. General. When Radio Receiver R-394/U is combined with certain pieces of equipment, it can be used as a part of four different radio sets. These sets are Radio Receiving Set AN/FRR-36, Radio Set AN/VRC-19, Radio Set AN/FRC-27, and Radio Set AN/TRC-28. A block diagram showing the components of these radio sets is shown in figure 2. Subparagraphs b through e below describe the function of Radio Receiver R-394/U in each of these radio sets.

b. Radio Receiving Set AN/FRR-36 (fig. 3). Radio Receiving Set AN/FRR-36 is the simplest of the group and is designed for single channel reception only. It consists of Radio Receiver R-394/U mounted in Electrical Equipment Cabinet CY-1150/U. The power source required is 115 or 230 volts at 50 to 60 cps, making it a fixed station set. The controls are on



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Figure 2. Radio Receiver R-394/U system application.



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Figure 3. Radio Receiving Set AN/FRR-36.

the front panel of the cabinet. The antenna is a vertical quarter-wave type.

c. *Radio Set AN/VRC-19(*)*. Radio Set AN/VRC-19(*) is a mobile receiver-transmitter designed to operate in a vehicle with a 6-, 12- or 24-volt storage battery. Radio Receiver R-394/U is interconnected in this radio set with Radio Transmitter T-278/U and its associated power supply by wiring in Electrical Equipment Cabinet CY-938/VRC. For normal use, the radio set is operated with push-to-talk control. Pressing a push-to-talk switch on a handset operates the transmitter and disables the receiver. Releasing the switch disables the transmitter and allows the receiver to operate. The receiver and transmitter may be operated simultaneously, however, for retransmission purposes. For retransmission, the audio output of the receiver is connected to the audio input of the transmitter, which transmits the signal at a different radio frequency. In effect, this retransmission process makes the radio set a mobile radio relay

station. The transmitter output power is approximately 30 watts.

d. *Radio Set AN/FRC-27*. Radio Set AN/FRC-27 is a fixed station (receiver and transmitter) which operates from an a-c (alternating-current) source of 115 or 230 volts at 50 to 60 cps (cycles per second). In this radio set the receiver has the same functions as in Radio Set AN/VRC-19(*). However, it is possible to use two radio receivers, instead of one. This permits two-way conversation to be carried on in addition to normal push-to-talk operation. A higher power transmitter (50 watts) than that in Radio Set AN/VRC-19 is used, thereby, increasing the range slightly. The fact that the radio set is fixed makes possible the erection of higher antennas which extend the range of the set. The radio set also has provision for local or remote control of the equipment.

e. *Radio Set AN/TRC-28*. Radio Set AN/TRC-28 consists essentially of Radio Set AN/FRC-27 plus a

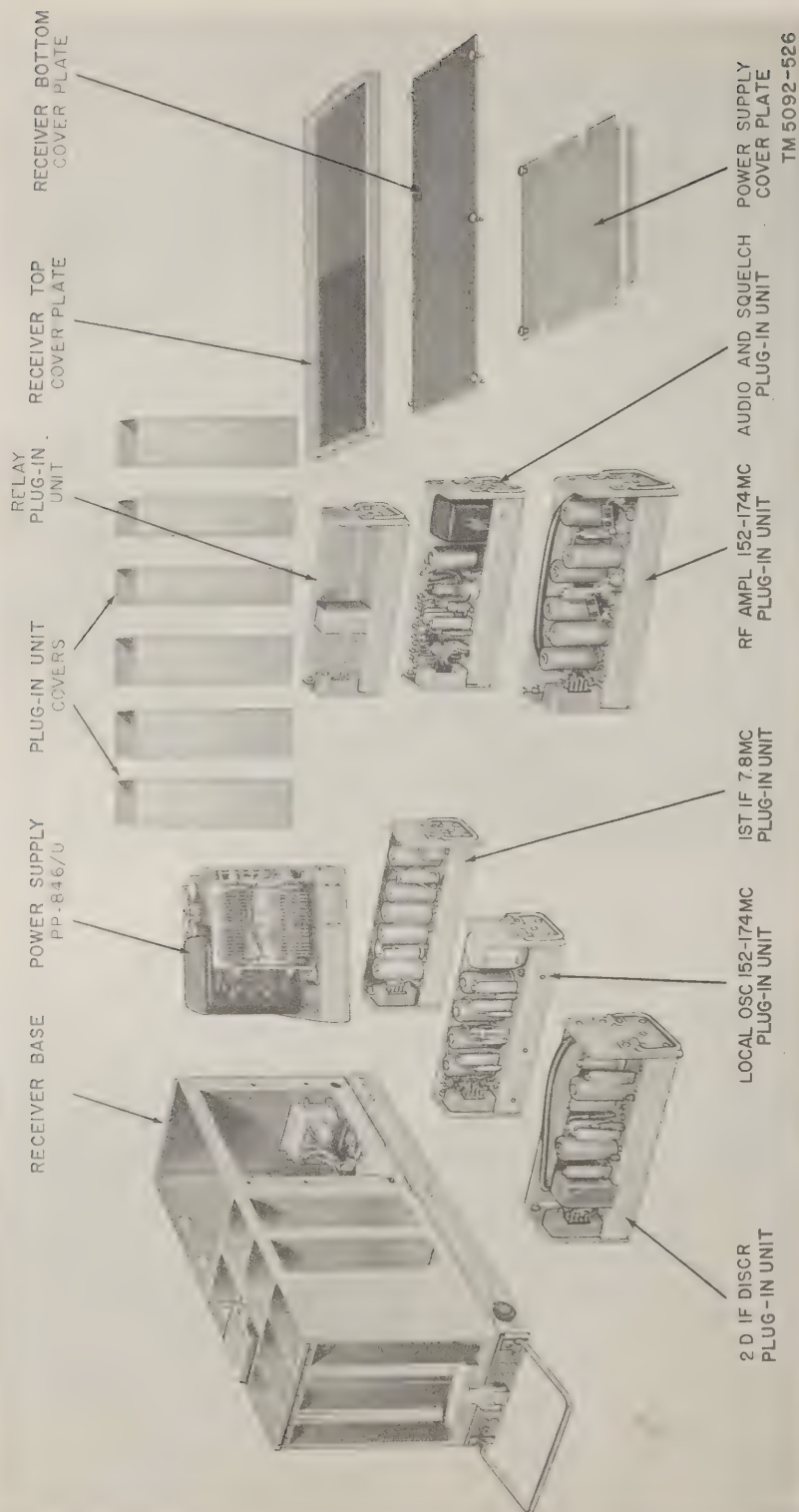


Figure 4. Radio Receiver R-394/U, components disassembled.

250-watt r-f (radio-frequency) power amplifier (Radio Frequency Amplifier AM-494/GR). This gives it a greater range than Radio Set AN/FRC-27.

5. Technical Characteristics

Frequency range.	152 to 174 mc.
Receiver type.	Double conversion, crystal controlled, superheterodyne, fixed frequency.
Crystal range (third overtone).	24.033 to 27.7 mc.
Types of signals which can be received	Fm (± 15 -kc (kilocycles) deviation).
Number of tubes	22.
Intermediate frequencies	7.8 mc and 455 kc.
Audio output impedance .	8 ohms.
Audio power output	.5 watt at less than 10% distortion.
Audio frequency response	300 to 2,500 cps ± 1 db (decibel) (without de-emphasis). 6 db octave ± 1 db (with de-emphasis).
Special features	Squelch and muting circuits.

Power input to radio set supplies:

Voltage source	Power Supply	Input current (amperes)
6 volts d-c (direct current).	Power Supply PP-869/U.	3.7
12 volts d-c.	Power Supply PP-868/U.	2.0
24 volts d-c.	Power Supply PP-867/U.	1.1
115 or 230 volts a-c.	Power Supply PP-846/U.	.4 at 115 volts. .2 at 230 volts.

Antenna.	1/4-wave vertical.
Weight	26 lb (including power supply).

6. Packaging Data

Radio Receiver R-394/U is shipped installed in the radio set case of which it is used as a component. Details of the radio set packaging will be found in the instruction book pertaining to the specific radio set. When necessary to ship Radio Receiver R-394/U separately the packaging will be performed in a manner that will keep it safe from moisture, shock, and vibration. Such packaging

consists of one water-resistant carton within a second water-resistant carton. The outside container is a wooden crate which is waterproofed. Adequate padding must be placed between layers of the package to absorb shocks.

7. Description of Radio Receiver R-394/U

a. General. Radio Receiver R-394/U requires a plug-in power supply and an external control unit in order to operate. The power supply provides filament and B+ voltages. The control unit turns the receiver on and distributes the audio output to a handset and/or speaker. The electrical connection to the particular radio set in which it is installed is accomplished by a single connector on the rear panel. A locking handle on the front panel controls a shaft passing through the receiver from front to rear. The rear end of this shaft is attached to a cam head which secures the receiver to the case in which it is used. A handle is provided on the front panel for pulling the receiver from the radio set case. Eight test points are provided at the front for checking the operation of the receiver and for alignment purposes. The chassis or receiver base assembly contains the following subassemblies (figs. 4 and 5):

- (1) RF AMPL 152-174 MC plug-in unit.
- (2) LOCAL OSC 152-174 MC plug-in unit.
- (3) 1ST IF 7.8 MC plug-in unit.
- (4) 2ND IF DISCR plug-in unit.
- (5) AUDIO & SQUELCH plug-in unit.
- (6) RELAY plug-in unit.
- (7) Selectivity filter.
- (8) Power supply (par. 5).

b. Receiver Base Assembly (fig. 4). The receiver base assembly is a honey-combed assembly with eight compartments or cells into which the eight units of the receiver are fitted. Except for the selectivity filter, Z251, which is wired to the receiver base, all of these units are plug-in units. These units are connected into the base when plugged into the proper compartment. The plugs and jacks on the receiver base are so arranged that the plug-in units fit only in the proper cell. The power supply is fastened to the receiver base by six screws. The power supply connector, P251, is connected to the power supply from the bottom side of the receiver. A handle on this plug aids in connecting and disconnecting the plug.

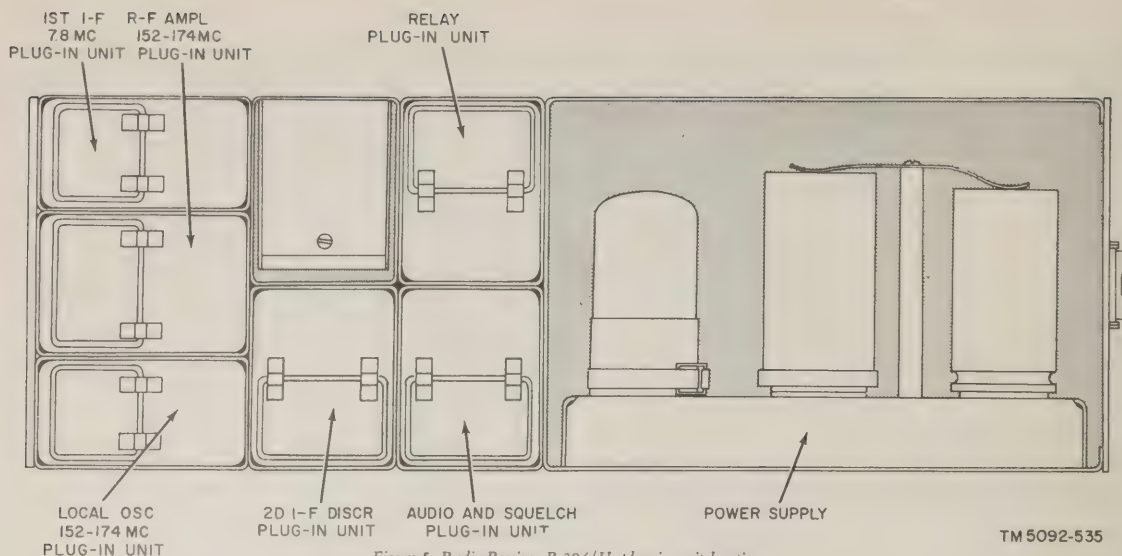


Figure 5. Radio Receiver R-394/U, plug-in unit location.

c. *Subassemblies.* Each plug-in subassembly has a handle to remove it from the receiver base. Each unit also is shielded by a snap-on type cover which can be removed for repair or alignment.

- (1) *RF AMPL 152-174 MC plug-in unit.* This unit contains three subminiature tubes; the first r-f amplifier V1, the second r-f amplifier V2, and the first mixer V3. A plug, P2, conveys filament and B+ voltages to the unit as well as agc (automatic gain control) voltage. A test point on the front of the receiver which facilitates measuring the voltage at the control grid of the first mixer stage, V3, is also wired through this plug. Three coaxial connectors, P1, P3, and P4, are used for antenna input, LOCAL OSC 152-174 MC plug-in unit output, and first mixer output to the 7.8-mc i-f (intermediate-frequency) amplifier, V51, in the 1ST IF 7.8 MC plug-in unit, respectively.
- (2) *LOCAL OSC 152-174 MC plug-in unit.* Four subminiature tubes are used in this unit: First h-f (high-frequency) oscillator V31, tripler V32, doubler V33, and voltage regulator V34. These tubes develop a signal which beats with the r-f signal in the first mixer stage to produce a 7.8-mc output. The voltage regulator tube, VR31, stabilizes the screen voltage of the first h-f oscillator. A crystal oven (E31) contains the crystal which determines the frequency of the first h-f oscillator. The oven, which also contains a heating element and a thermostat, maintains a temperature of approximately 75° C. Power is supplied to this plug-in unit through plug P32. R-f output is supplied through coaxial plug P31.

- (3) *1ST IF 7.8 MC plug-in unit.* This plug-in unit contains three subminiature tubes which are the 7.8-mc i-f amplifier, V51, the second mixer, V52, and the second h-f oscillator V53. This plug-in unit amplifies the 7.8-mc output of the RF AMPL 152-174 MC plug-in unit and then beats it with a signal from the second h-f oscillator in order to deliver a 455-kc signal to selectivity filter Z251 through coaxial plug P53. The 7.8-mc input to this plug-in unit is through another coaxial plug, P52. Power and a front panel test point (RF) are routed through plug P51.
- (4) *2ND IF DISCR plug-in unit.* This plug-in unit contains seven subminiature tubes which amplify and amplitude limit the 455-kc i-f signal. It also contains two germanium diodes in a discriminator circuit which converts f-m to audio signals. Filament filter FL82 is located in this plug-in unit. One coaxial plug, P81, connects the output of the selectivity filter into this plug-in unit. Plug P82 is the connector which carries power to this plug-in unit and also provides connections to three test points at the front of the receiver. These are marked 1ST IF, 2ND IF, and DISCR.
- (5) *AUDIO & SQUELCH plug-in unit.* This unit contains four subminiature tubes and one miniature tube. Two tubes are audio amplifiers and the remaining three are used in a squelch circuit. Screw-driver-adjusted audio level control R127 is mounted on this unit and is accessible when the shield cover is removed. All connections to this plug-in unit are made through plug P121.

(6) *RELAY plug-in unit.* This unit is connected to the receiver base through plug P271 and is protected by a shield cover. When desired, the relay may be wired into the receiver circuit to control a transmitter in a re-transmission installation.

(7) *Selectivity filter.* Selectivity filter Z251 is permanently mounted in one of the receiver cells, and is connected between the 7.8-mc i-f amplifier (V51) and the first 455-kc i-f amplifier with coaxial cables. It is a sealed unit with no adjustments and provides the proper band pass for the 455-kc i-f stages.

d. Cover Plates. Three cover plates are provided with the receiver. The top cover plate is fastened down with a latch at the rear end of the receiver. The bottom cover plate fastens to the receiver base with six Airloc fasteners, and the side (power supply) cover plate fastens to the receiver base with two Airloc fasteners.

8. Power Supplies

Power Supply PP-846/U (fig. 6) is used to supply filament, plate, and bias voltages to Radio Receiver R-394/U when used in Radio Receiving Set AN/FRR-36. The power supply chassis mounts in a vertical plane and is fastened to the receiver base with six screws. Voltage is applied to the receiver through jack J3001 on the power supply and plug P251 on the receiver base. This power supply operates on 115- or 230-volt a-c. For further details on Power Supply PP-846/U, see the power supply instruction book. Power Supplies PP-869/U, PP-868/U, and PP-867/U, which can

also be used to power the receiver, are similar to Power Supply PP-846/U except that they operate from 6-, 12-, or 24-volt d-c, respectively. The power supplies are additional equipments which are furnished as a part of an over-all radio set or requisitioned separately.

9. Running Spares

a. No spare parts are furnished with Radio Receiver R-394/U. However, receiver running spares are furnished with the various radio sets in which it is used. Consult the instruction books pertaining to the set used for a listing of receiver spare parts.

b. Since certain tubes used in Radio Receiver R-394/U are used also in the companion transmitter, the quantities supplied as running spares will depend upon the total quantity used in both the receiver and the transmitter.

c. Radio Receiver R-394/U uses 22 tubes as follows:

1 tube 5840
4 tubes 1AD4
1 tube 5783
14 tubes 5678
1 tube 5672
1 tube 6AK6

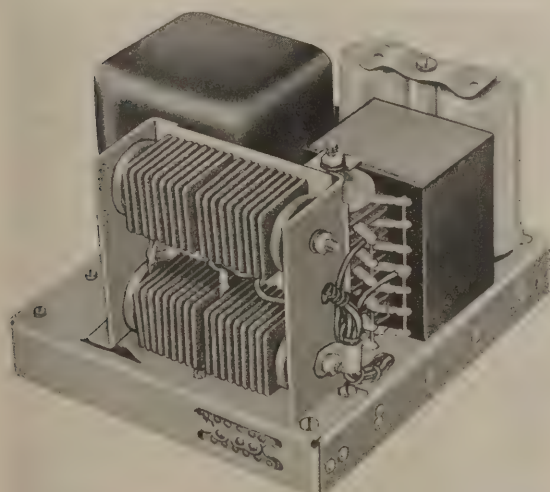
10. Additional Equipment Required

a. General. Radio Receiver R-394/U is dependent upon a power supply and power source, a case (or housing), a control unit, and an antenna for complete operation.

b. Power Supply. The power supply used to power Radio Receiver R-394/U depends upon the radio set and power source being employed (see par. 8). These power supplies are mounted in the receiver base assembly and are connected to the receiver with a removable plug.

c. Receiver Cabinet. The cabinet which contains Radio Receiver R-394/U is determined by the radio set employed. For purposes of explanation and clarification, Electrical Equipment Cabinet CY-1150/U is illustrated and referred to in this instruction book. When Radio Receiver R-394/U is plugged into this cabinet, it forms a complete radio set (Radio Set AN/FRR-36).

d. Control. A control unit, including a switch for turning the power on and off, an audio level or volume control, a squelch control and squelch disable switch, also is needed for the operation of Radio Receiver R-394/U. The specific control used also depends upon the radio set employed. For the purpose of explanation and clarification in



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Figure 6. Power Supply PP-846/U.

this instruction book the controls of Electrical Equipment Cabinet CY-1150/U (fig. 3) are illustrated and referred to when necessary.

e. Antenna. The antenna used for Radio Receiver R-394/U is a quarter-wave vertical type. Connection is made through a length of coaxial cable.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

11. General

Equipment may be shipped in overseas packing cases or in domestic packing cases, and, sometimes, in its own carrying case. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the permanent or semipermanent installation of the equipment.

Caution: Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged or exposed, a complete overhaul may be required or the equipment may be rendered useless.

12. Uncrating, Unpacking, and Checking New Equipment

a. Uncrating and Unpacking. Radio Receiver R-394/U is not packaged as a separate unit, but as a component in one of the radio sets incorporating its use. Detailed information pertaining to the unpacking and uncrating of the radio sets is contained in the pertinent radio set instruction book.

b. Checking. Inspect Radio Receiver R-394/U for damage which may have occurred during shipment. If a packing slip is contained in the carton, check it against the contents and for any other information pertaining to it.

c. Repacking. To repack the receiver, reverse the procedure used for unpacking.

13. Installation of Receiver

a. Before installing the receiver, check it for damage by removing the cover plates and examining the internal parts. Remove the top cover by releasing the latch at the rear of the receiver (fig. 7). With the top cover off, all the plug-in units can be removed. Take off the shield on each unit (fig. 4) and examine it for the items listed below:

- (1) Broken or cracked tubes. (Refer to figures 8 through 12 for tube locations.)
- (2) Cracked, loose or otherwise defective

parts, such as resistors, capacitors, terminal boards, and connectors.

- (3) Broken wires or frayed insulation.
- (4) Dirt, moisture, or foreign material.
- (5) Broken or bent pins on plug-in unit connectors.

b. Remove the bottom cover which is secured to the receiver base with six Airloc fasteners. Inspect for defects listed in subparagraphs a(2), a(3), and a(4), and for mechanical structures for obvious damage.

c. Remove the side cover by loosening the two Airloc fasteners, and withdrawing the cover. Remove the power supply by first disconnecting plug P251 (on the under side of the receiver base) from the power supply connector (fig. 13) and then loosening and unscrewing the six binder head screws. The power supply can now be lifted out of the receiver base assembly. Check for damage to the power supply. Then reinsert the power supply in the receiver base and reconnect P251 to the power supply connector.

d. If the receiver passes this inspection satisfactorily, reassemble the plug-in units and insert the receiver in the radio set case. The main receiver connector P252 should engage the connector in the case. After this has been accomplished, tighten the lock-in rod by turning it clockwise.

e. Make sure that the power connector of the radio set is connected and that power is available. The power cable connects either to a 6-, 12-, or 24-volt battery or to a 115- or 230-volt a-c line depending on which radio system Radio Receiver R-394 is used with. Refer to the pertinent radio set instruction book for specific power connections.

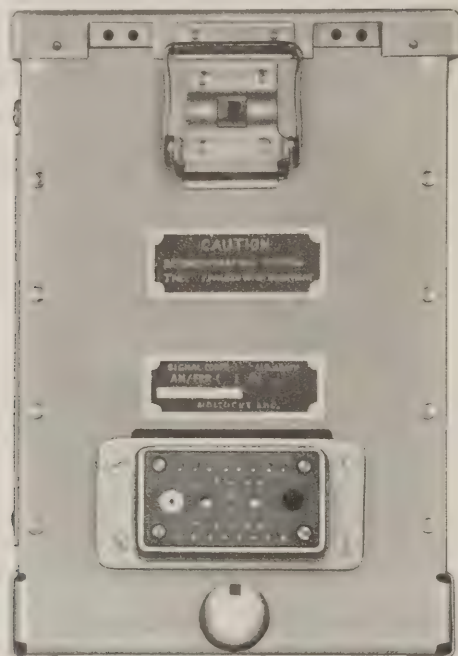
14. Service Upon Receipt of Used or Reconditioned Equipment

a. Refer to the instructions given in paragraph 12 when unpacking used or reconditioned equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes

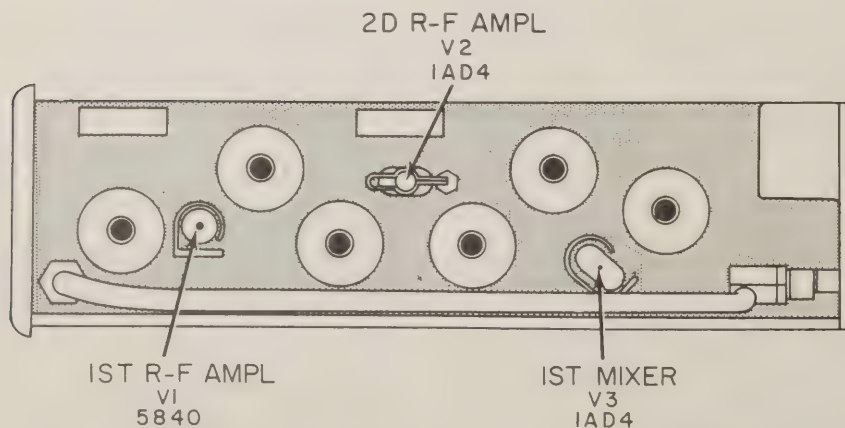
in wiring of the equipment. If any changes have been made, note the change in the instruction book, preferably on the schematic diagram.

c Follow the installation procedures given in paragraph 13.



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Figure 7. Radio Receiver R-394/U, external connection and cover latch.



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Figure 8. Radio Receiver R-394/U, RF AMPL 152-174 MC plug-in unit, tube location.

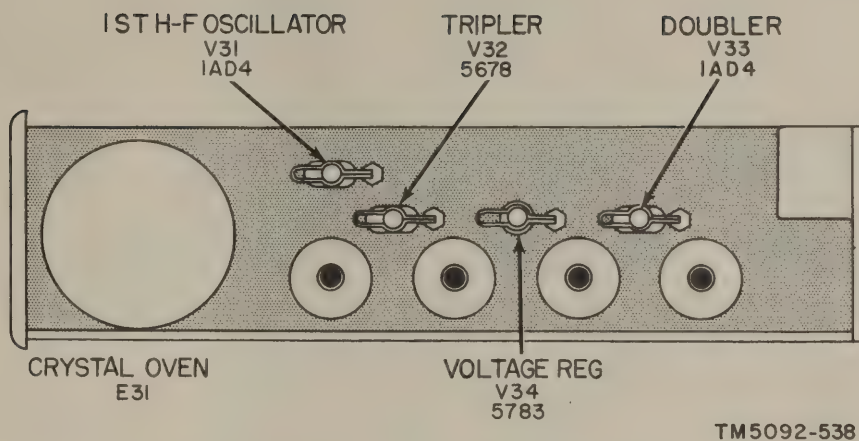


Figure 9. Radio Receiver R-394/U, LOCAL OSC 152-174 MC Plug-in unit, tube location.

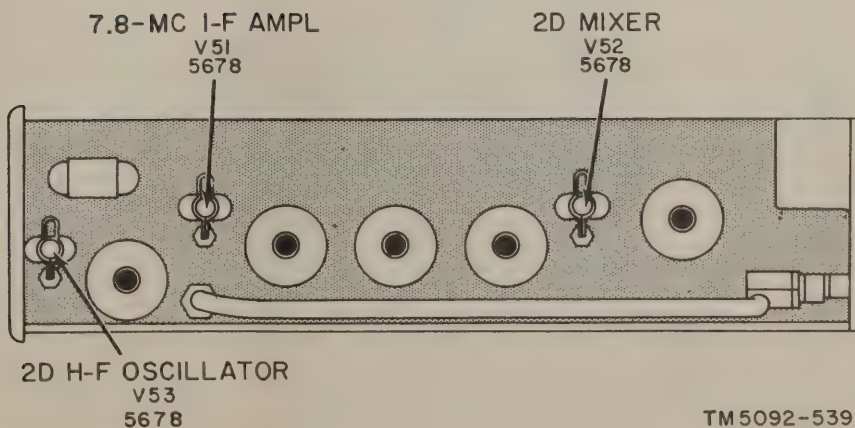


Figure 10. Radio Receiver R-394/U, IST IF 7.8 MC plug-in unit, tube location.

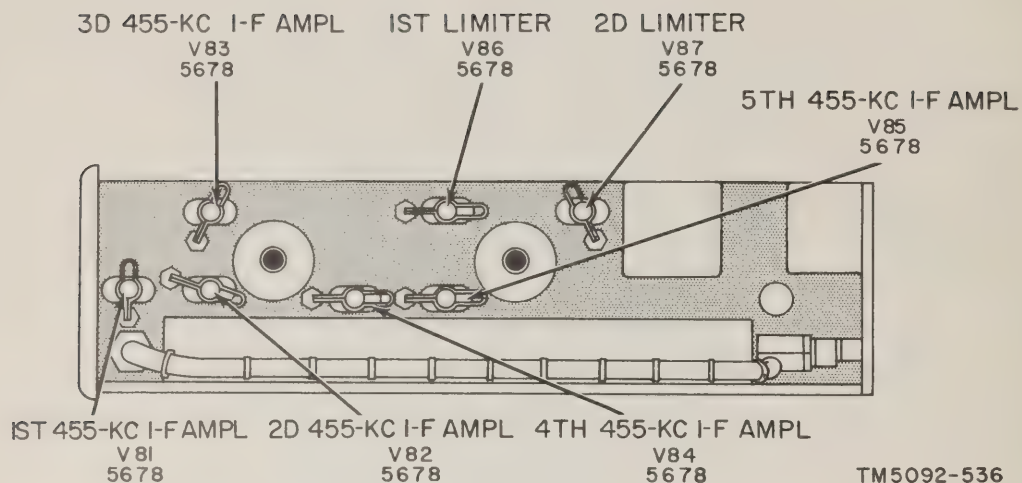


Figure 11. Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, tube location.

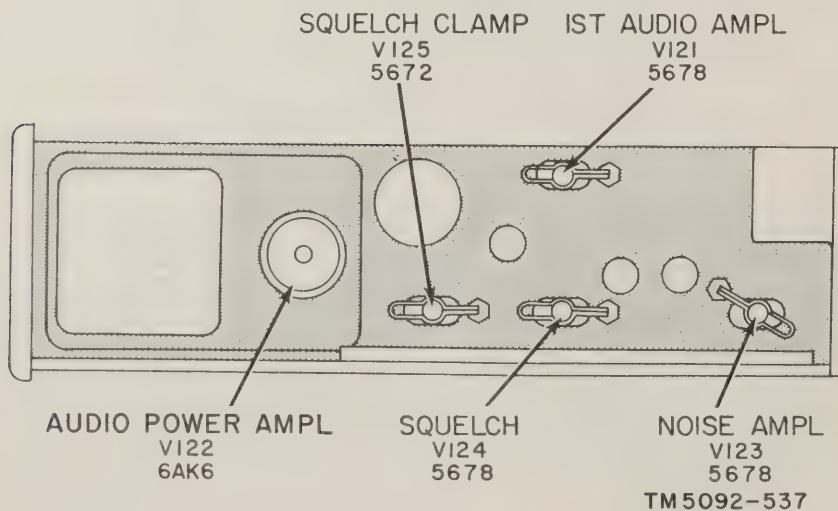
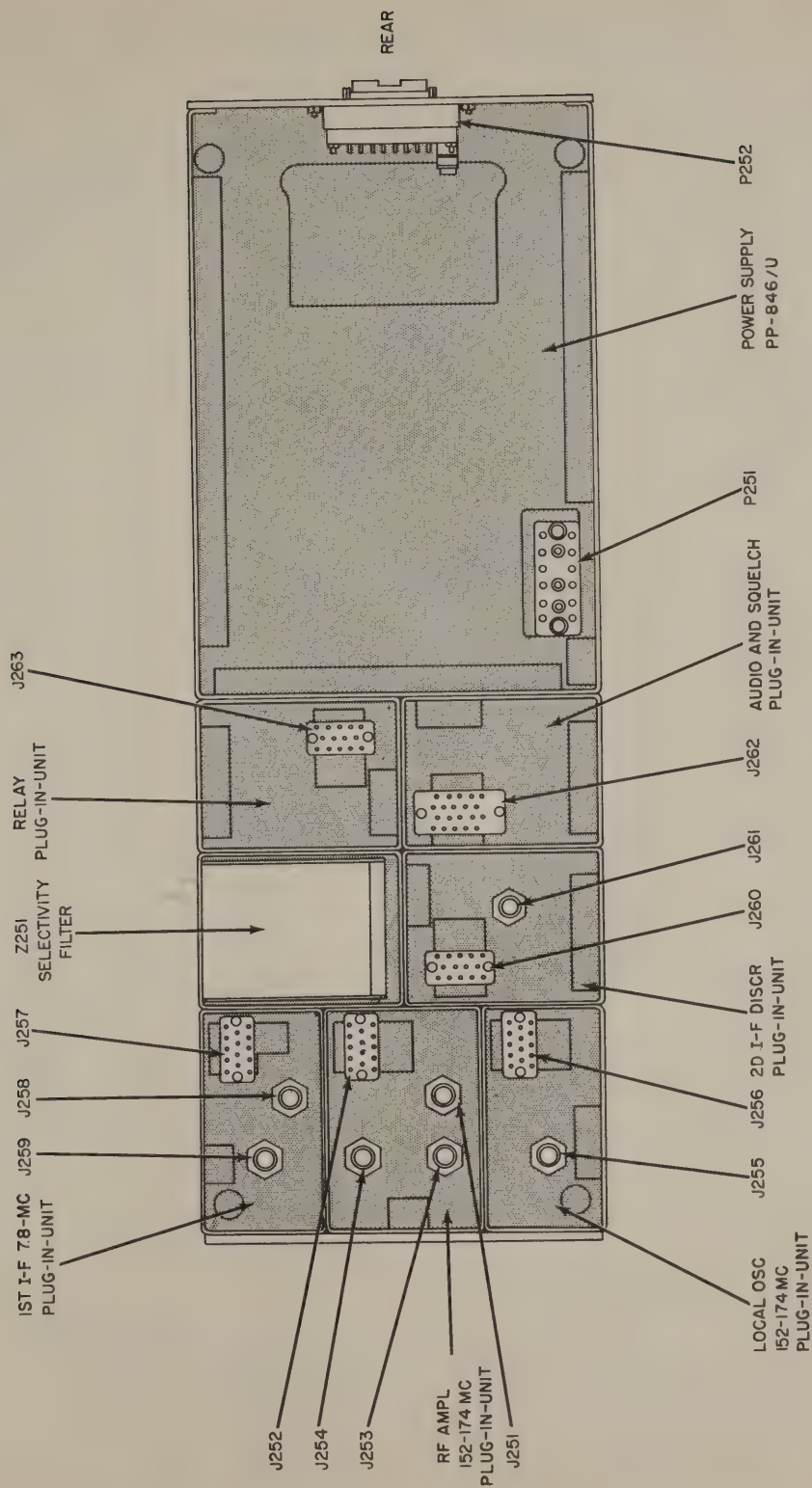
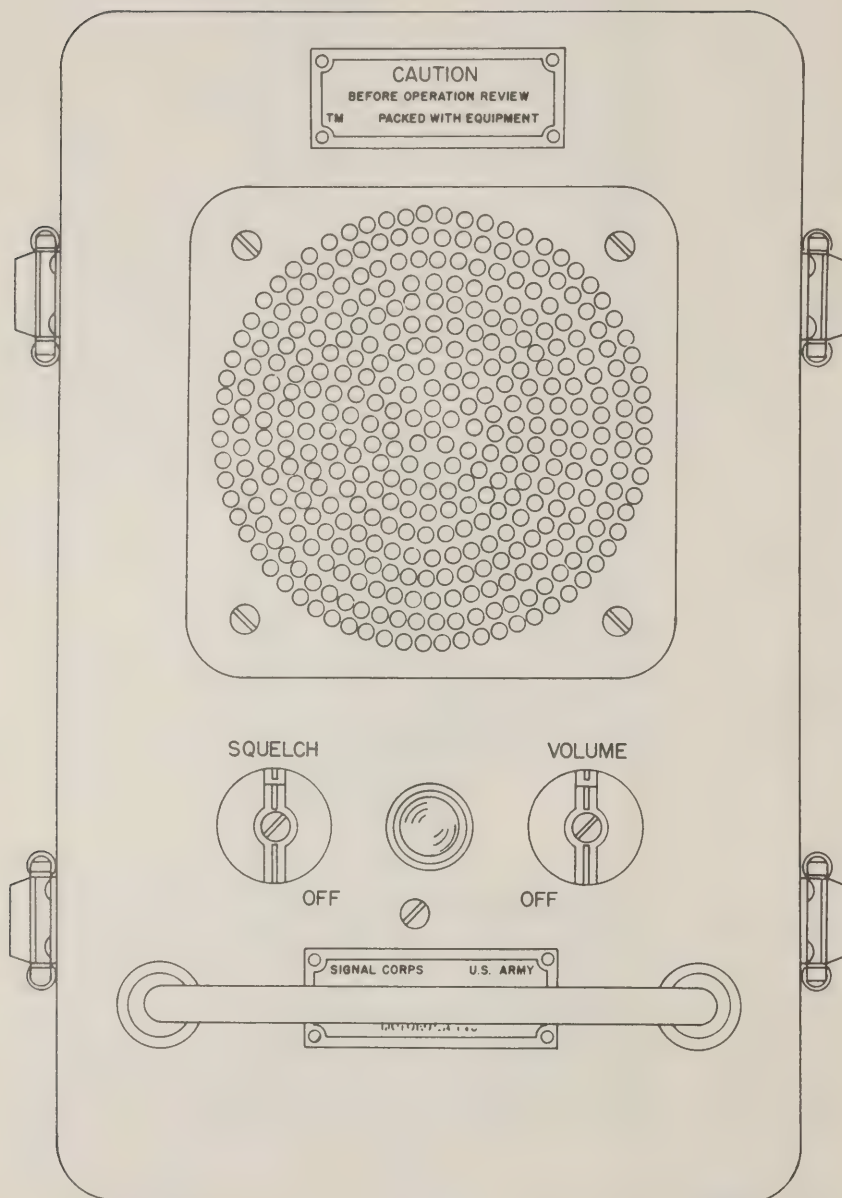


Figure 12. Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, tube location.



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Figure 13. Radio Receiver R-394/U, compartment location.



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Figure 14. Radio Receiving Set AN/FRR-36, front panel controls.

Section II. CONTROLS AND INSTRUMENTS

15. General

Haphazard operation or improper settings of the controls often cause damage to electronic equipment. For this reason, it is important to know the function of each control. The actual operation of this equipment is discussed in the section III of this chapter.

16. Controls and Their Uses (fig. 14)

The following chart lists the controls of Radio Receiving Set AN/FRR-36. The controls discussed in this instruction book are the ones contained in Electrical Equipment Cabinet CY-1150/U and are similar to those in other systems which include Radio Receiver R-394/U.

Control	Function
SQUELCH Control (R2408)	Sets the squelch threshold level, as determined by the operator of the receiver. Minimum squelch action is in the CW (clockwise) direction.
Squelch OFF Switch (S2402)	Ganged to R2408. In the extreme CW position, the switch is closed and prevents the squelch circuit from operating.
VOLUME Control (S2401A)	Audio level step attenuator. Operator has option of four fixed audio levels. Maximum volume is in the extreme CW position.
Power OFF Switch (S2401B)	Ganged with S2401A. In the fifth or extreme CCW (counter-clockwise) position the switch opens the circuit to the power source (115- or 230-volts ac or 6-, 12-, or 24-volts dc).
POWER indicator Lamp	Lamp lights when power is turned on.

Section III. OPERATION UNDER USUAL CONDITIONS

17. Initial Adjustment of Receiver

The only adjustment to be performed on Radio Receiver R-394/U prior to actual operation is that of setting it to the required frequency of operation. This operation is performed as follows:

a. Grasp the LOCAL OSC 152-174 MC plug-in unit by the handle and lift it out of the receiver base. Remove the shield cover and locate the crystal oven E31 (fig. 15).

b. Remove the crystal oven, using a screwdriver if necessary to pry it out of the octal socket. If the use of a screwdriver is required, exercise caution so as not to damage the socket or any of the subminiature tubes.

c. Remove the cover from the oven after first removing the three screws which secure the cover to the base of the oven. Remove the heater element assembly, noting the contact arrangement.

d. Insert the proper crystal into the socket provided for it.

Caution: The crystal and the thermostat are similar in appearance and can be easily plugged into the wrong holes. If in doubt about the proper location of each, refer to the decal fastened to the plug-in unit indicating the proper location.

e. Select the proper crystal for the frequency of operation desired. Use the following formula for determining the crystal frequency:

$$\text{Crystal frequency (mc)} = \frac{F - 7.8}{6}$$

where F = frequency (in mc) of operation desired).

Example:

If the operating frequency is 165.0 mc, then, crystal frequency

$$\begin{aligned} &= \frac{F - 7.8}{6} \\ &= \frac{165.0 - 7.8}{6} \\ &= \frac{157.2}{6} = 26.2 \text{ mc.} \end{aligned}$$

f. Reassemble the crystal oven by reversing the disassembly process, and plug it into the octal socket. Insert the LOCAL OSC 152-174 MC plug-in unit, without the shield cover, back into the receiver base.

g. Connect one end of the patch cord (fig. 38) to connector P252 of the receiver and connect the other end of the patch cord to a connector such as J2401 in Electrical Equipment Cabinet CY-1150/U (fig. 39). Aline the two r-f amplifiers V1 and V2 and the LOCAL OSC 152-174 MC plug-in unit as described in paragraph 91.

18. Starting Procedure

a. *Preliminary.* Set the VOLUME and SQUELCH controls on the control unit at OFF.

b. *Starting.* Move the VOLUME control to the third position clockwise. The POWER pilot lamp will light and a signal or rushing noise will be heard from the speaker within 15 or 20 seconds.

19. Volume Adjustment

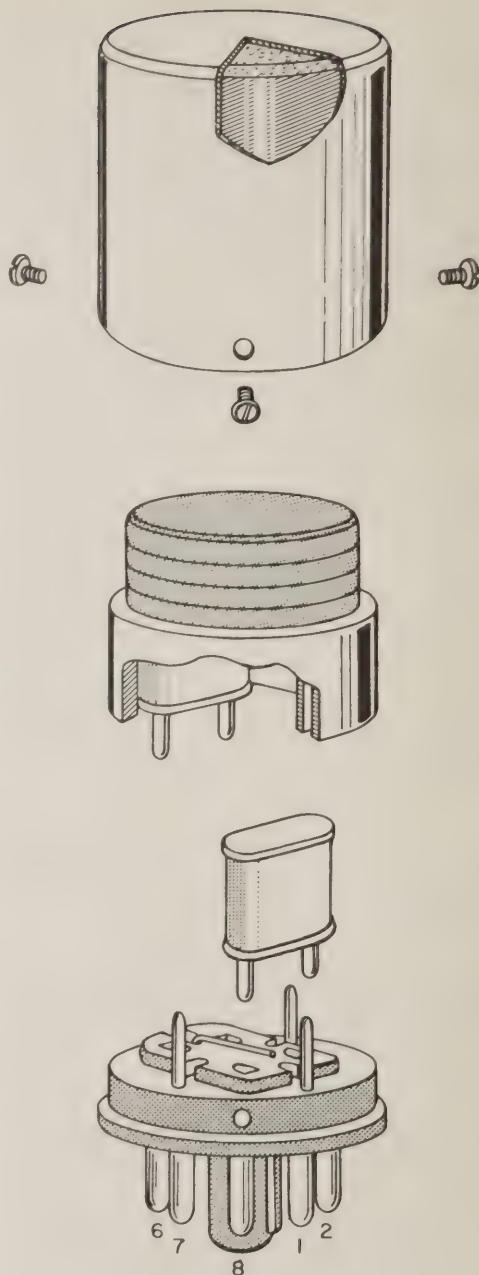
The volume of the receiver is adjusted by advancing the VOLUME switch clockwise for more output. The operator has an option of four audio volume levels, the lowest being at a position one step clockwise from the OFF position, and the maximum at the fully clockwise position. Adjust the switch for a comfortable level of sound.

20. Squelch Adjustment

a. When the SQUELCH control is in the OFF position, the receiver is unsquelched. This permits the receiver to receive any strength signal without cutting off the audio output. The SQUELCH control can be adjusted to mute the receiver output when a weak signal or no signal is being received. The setting at which this occurs is called the squelch threshold level.

b. Adjust the SQUELCH control as follows:

- (1) Turn the SQUELCH control to its fully clockwise position (not OFF) and note whether a signal or just noise is being received.
- (2) At an interval when no signal is heard, turn the SQUELCH control counterclockwise until the background noise disappears, but no further.
- (3) When the noise level is high, and signal strength low, it may be desirable to operate with the SQUELCH control in the OFF position. Otherwise there will be intermittent or no reception. In the event that the squelch circuit behavior is erratic and repair on



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Figure 15. Radio Receiver R-394/U, first high-frequency oscillator crystal oven.

this circuit is not practical, the squelch circuit can be disabled effectively by setting the SQUELCH control in the OFF position.

21. Stopping Procedure

a. Rotate the SQUELCH control fully clockwise until a click is heard.

b. Rotate the VOLUME control fully counterclockwise to the OFF position.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

22. General

The operation of Radio Receiver R-394/U may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of these unusual operating conditions.

23. Operation in Artic Climates

Subzero temperatures and climatic conditions associated with cold weather effect the efficient operation of equipment. Instructions and precautions for operation under such adverse conditions follow:

- a.* Handle the equipment carefully.
- b.* Keep the equipment warm and dry.
- c.* If water gets into the handset receiver, or if moisture condenses within it, the actuation of the diaphragm may be impeded. When this happens, remove the bakelite cap and remove the ice and moisture from the receiver.
- d.* When equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. This condition also arises when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

24. Operation in Tropical Climates

When operated in tropical climates, fixed station radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground or in swampy areas, moisture conditions are more acute than

normal in the tropics. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs near (or in) the equipment.

25. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, and dirt that enters the radio equipment. The ideal precaution is to house the equipment in a dust-proof shelter. Since such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and anchor the side walls of the tent to prevent flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Be careful that the equipment is as free from dust as possible. Make frequent preventive maintenance checks (Ch. 3). Pay close attention to the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

26. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that break-downs and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair, since its object is to prevent certain troubles from occurring. Refer to AR 750-5.

27. Tools, Materials, and Test Equipment Supplied with Radio Receiver R-394/U

An alinement tool is supplied with the receiver. However, other items such as Allen wrenches are furnished with the radio set of which the receiver is a component. Consult the instruction book of the radio set incorporating Radio Receiver R-394/U for a listing of the tools, materials, and test equipment provided.

28. General Preventive Maintenance Techniques

a. Use #0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) Clean all parts, except electrical contacts, with a cloth or brush moistened with Solvent, dry cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air may be used at line pressures not exceeding 60 pounds per square inch to remove dust from nonaccessible places; be careful, however, or mechanical damage from the air blast may result. Do not use the air blast on speaker cones or meter movements.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

29. Use of Preventive Maintenance Form (fig. 16)

a. The decision as to which items on DA AGO Form 11-239 are applicable to this equipment is to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for use appear on the reverse side of the form.

b. Circled items in figure 16 are partially or totally applicable to Radio Receiver R-394/U. References in the ITEM block refer to paragraphs in the text which contain additional maintenance information.

30. Performing Exterior Preventive Maintenance

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will become damaged or broken.

a. Check for completeness of equipment; spare parts, instruction books, and accessories.

b. Remove moisture from the main receiver connector P252.

c. Check for normal operation. If abnormal results occur at any point in the operating procedure, refer to the equipment performance checklist (par. 38).

d. Clean and tighten the receiver case.

e. Inspect metal surfaces for corrosion, dirt, and moisture.

f. Inspect the test points on the front panel for looseness and cracked insulation.

g. If deficiencies noted are not corrected during inspection, indicate on DA AGO Form 11-239 the action taken to initiate correction.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT			
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR			
EQUIPMENT NOMENCLATURE		INSTRUCTIONS: See other side	
		EQUIPMENT SERIAL NO.	
LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ① Defect corrected. NOTE: Strike out items not applicable.			
NO	ITEM	NO	ITEM
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying case, wire and cable, microphone, tubes, spare parts, technical manuals and accessories). PAR 30a	19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR 31d
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.	20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR 30b	21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR 31d
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.	22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.	23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.
6	CHECK FOR NORMAL OPERATION. PAR 30c	24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR 31e
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR 30d	25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS.
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR 30e	26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN.	27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.	28	CHECK SETTINGS OF ADJUSTABLE RELAYS.
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR WILDER, TEARS, AND FRAYING.	29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELFTHS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.	30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR 31f
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.	32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE.
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	34	INSPECT CATHODE RAY TUBES FOR BURNED SCREEN SPOTS.
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. PAR 30f	36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.	37	MOISTURE AND FUNGIPROOF. PAR 31g

DA AGO FORM 11-239
1 MAY 52

REPLACES DA AGO FORM 119, 1 DEC 50, WHICH IS OBSOLETE.

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Figure 16. DA AGO Form 11-239.

31. Performing Interior Preventive Maintenance

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation (par. 38).

a. Inspect the seating of readily accessible pluck-out items: All plug-in units, tubes, crystal oven E31, crystal Y51, and all plugs and jacks.

b. Inspect cabling under the receiver base for cuts, breaks, fraying, deterioration, kinks and strain.

c. Inspect all tubes for loose or damaged terminals, insufficient socket spring tension; clean dust and dirt carefully; check emission of all tubes;

refer to figures 8 through 12 for tube location diagrams.

d. Inspect all fixed capacitors for leaks, bulges, and excessive discoloration.

e. Inspect resistors and insulators for cracks, chipping, blistering, discoloration, and moisture.

f. Clean and tighten connections and mountings for audio output transformer T121 and relay K271.

g. Check moistureproofing and fungiproofing.

h. If deficiencies noted are not corrected during inspection, indicate on DA AGO form 11-239 the action taken to initiate correction.

Section II. LUBRICATION AND WEATHERPROOFING

32. Lubrication

No lubrication is required for Radio Receiver R-394/U.

33. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised

which, if properly applied, provides a reasonable degree of protection. This treatment is fully explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are fully explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are fully explained in TB SIG 75.

Section III. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

34. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, defective plug-in units, etc.

b. The paragraphs which follow in this section help in determining which of the stages is defective and in localizing the fault in that stage to the defective item such as a plug-in unit or connector. Figure 41 shows a subassembly partially out of the shield.

35. Visual Inspection

a. Failure of Radio Receiver R-394/U usually will be caused by one of the following faults:

- (1) Defective plug-in unit.
- (2) Improperly connected power cables.
- (3) Plugs and jacks connecting the plug-in units or power supply improperly seated, loose, or damaged.
- (4) Burned-out fuse in the receiver power supply.
- (5) Wires loose or broken because of excessive vibration or wear.

(6) Defective or loose tubes.

(7) Inactive (dirty or cracked) h-f oscillator crystals.

Note. If the SQUELCH control is advanced too far counterclockwise, no audio output will be obtained. In order to eliminate this possibility, turn the SQUELCH control fully clockwise until the squelch disable switch is locked in the OFF position.

b. When a receiver failure is encountered and the cause is not apparent, check as many of the foregoing items as is practical and in accordance with the echelon service level handling the receiver. If the operator who was using the receiver at the time of failure is available, consult him for any particulars or details pertaining to the receiver failure.

c. Visually inspect the antenna system for obvious defects.

36. System Sectionalization of Trouble to a Plug-in Unit

Radio Receiver R-394/U is designed so that most defects can be remedied by removing the defective plug-in unit and inserting a similar plug-in unit. The procedure to follow when trouble shooting the receiver consists of replacing one plug-in unit at a time until the defective plug-in unit is located. (Replacement of plug-in units may be performed only by qualified personnel.) The plug-in units used for substitution must be properly alined before substitution. The AUDIO & SQUELCH, the 2ND IF DISCR, and the 1ST IF 7.8 MC plug-in units are factory adjusted to a fixed setting regardless of the operating signal frequency, but the RF AMPL 152-174 MC, and the LOCAL OSC 152-174 MC plug-in units must be accurately alined to the specific frequency or channel to be used for reception. If the alinement of these last two units is not correct, the receiver will not be tuned to the desired channel. Be sure to determine the operating frequency of the plug-

in units beforehand and remember that the RF AMPL 152-174 MC and LOCAL OSC 152-174 MC plug-in units have to be matched (in alinement) to give the desired results. Refer to paragraphs 17 and 91 for alinement of these units.

37. Trouble Shooting by Use of Equipment Performance Checklist

a. General. The equipment performance checklist will help the operator to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. To use this list, follow the items in numerical sequence.

b. Action or Condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference (in the chart) to chapter 5 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the situation requires that communication be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

38. Equipment Performance Checklist

a. Preparatory.

Item No.	Item	Action or condition	Normal indications	Corrective measures
1	Receiver main connector.	Receiver main connector P252 properly engaging its mating connector in the case.		
2	Power supply connector.	Power supply connector P251 (on receiver) prop-		

Item No.	Item	Action or condition	Normal indications	Corrective measures
3	Plug-in unit connectors.	erly connected to its mating connector in the power supply. Plug-in unit connectors properly connected. Be sure plug-in units are properly inserted in their respective compartments. Cover should be installed correctly and latched.		
4	SQUELCH control.	SQUELCH control in extreme clockwise position so that squelch disable switch is in the OFF position.		
5	VOLUME control.	VOLUME control in the extreme counterclockwise position so that power switch is in the OFF position.		

b. Start.

Item No.	Item	Action or condition	Normal indications	Corrective measures
6	VOLUME control.	Advance control clockwise 2 or 3 positions.	POWER indicator lamp lights; rushing noise or signal is heard in speaker.	Check power supply fuse. Check power supply connector P251. Check receiver main connector P252. Check the receiver plug-in units by substitution (par. 36). If this test reveals a defective plug-in unit, tag it as such and replace it.

c. Equipment Performance.

Item No.	Item	Action or condition	Normal indications	Corrective measures
7	VOLUME control.	Turn to extreme clockwise position.	Rushing noise or signal is heard at maximum volume.	If the volume of the noise is low or the signal is low and/or distorted, check the plug-in units by substitution (par. 36).

c. Equipment Performance (cont'd)

Item No.	Item	Action or condition	Normal indications	Corrective measures
8	SQUELCH control.	(a) With no signal and only noise coming through the loud speaker, turn this control counterclockwise until the rushing noise stops. (b) Turn clockwise until rushing noise is heard again.	(a) The rushing noise is quieted. If possible, turn on a transmitter tuned to the receiver frequency. This transmitted signal should be audible in the loudspeaker when modulated (speech). (b) The receiver is now unsquelched.	(a) If the squelch control is inoperative check by substituting another audio and squelch plug-in unit (par. 36). (b) If the receiver fails to unsquelch, or the squelching action is erratic, check by substitution of the audio and squelch plug-in unit (par. 36). Check SQUELCH control. See radio set instruction book.

d. Stop.

Item No.	Item	Action or condition	Normal indications	Corrective measures
9	SQUELCH control.	Turn fully clockwise so that squelch disable switch is in the OFF position.	Rushing noise or signal continues.	
10	VOLUME control.	Turn fully counterclockwise so that the power switch is in the OFF position.	POWER indicator lamp goes out. No noise or signal is heard in the loudspeaker.	Check for shorted power switch or incorrect radio set connections. See radio set instruction book.

CHAPTER 4

THEORY

39. General

a. Radio Receiver R-394/U is a crystal-controlled, fixed-frequency, double-conversion, super-heterodyne f-m receiver. It is designed to operate on a fixed frequency within the 152-mc to 174-mc band. There are four different power supplies which can power this receiver, the selection depending on the power source available and the radio set of which the receiver is a component part.

b. The receiver is not a complete receiving system, since it has no controls or power supply. In order to maintain continuity and completeness of explanation, a 115- or 230-volt power supply (Power Supply PP-846/U) for power and a case (Electrical Equipment Cabinet CY-1150/U), which contains the necessary controls for the operation of the receiver, are referred to in this instruction book. When Radio Receiver R-394/U is used with these components it forms Radio Set AN/FRR-36 which is described in another instruction book.

c. The receiver has six plug-in units which are marked:

- (1) RF AMPL 152-174 MC.
- (2) LOCAL OSC 152-174 MC.
- (3) 1ST IF 7.8 MC.
- (4) 2ND IF & DISCR.
- (5) AUDIO & SQUELCH.
- (6) RELAY (optional use).

d. The unique feature of plug-in units necessitates the use of numerous plugs, jacks, and connectors. A thorough familiarity and understanding of these plugs, jacks, and connectors will simplify the work of the technician.

40. Block Diagram

(fig. 17)

a. The signal path through the receiver is shown in the block diagram of figure 17. An f-m signal is fed into first r-f amplifier V1, where it is amplified, and then amplified still further by the action of second r-f amplifier V2. The selectivity of the two r-f amplifiers improves the signal plus noise-

to-noise ratio and the image and i-f rejection ratios. The amplified signal is coupled to first mixer V3 together with a signal from the LOCAL OSC 152-174 MC plug-in unit (containing V31, V32, and V33) which is 7.8 lower in frequency than the incoming r-f signal. Sum and difference beat frequencies result, but only the difference frequency (7.8 mc) is passed by the following stage, 7.8-mc i-f amplifier V51. This stage amplifies the 7.8-mc f-m signal, and couples it to second mixer V52. Once again two frequencies are mixed together, producing sum and difference frequencies: 7.8 mc from second mixer V52, and 7.345 mc from crystal controlled second high-frequency oscillator V53. The difference (beat) frequency is 455 kc. This 455-kc signal is fed through selectivity filter Z251 which is tuned to the second i-f frequency of 455 kc. This signal is then amplified by five 455-kc i-f amplifier stages (tubes V81 through V85). The output of tube V85 passes through two limiter stages (V86 and V87) which maintain a constant amplitude voltage output to the discriminator even though the signal from the antenna may fluctuate due to noise or fading. The discriminator stage changes the f-m signal into an audio voltage, which is amplified by first audio amplifier V121 and audio power amplifier V122, to a level which facilitates reception with a speaker or handset.

b. Audio output from the discriminator is also fed to a squelch circuit. Noise amplifier V123 amplifies receiver noise and couples this signal to squelch tube V124 which controls the operation of the audio amplifiers (V121 and V122) by biasing their control grids to cutoff when no signal is being received. A SQUELCH control and squelch disabling switch are provided in the various radio set control units. The squelch clamp tube (V125) reinforces the action of the squelch tube (V124).

c. A RELAY plug-in unit (the use of which is optional) contains a relay which is controlled by the audio power amplifier, V122. This relay can be used to operate external circuits such as call signals or it can be used to control a transmitter in a retransmission installation.

d. Strong signals produce a negative voltage at the grid of the fifth 455-kc i-f amplifier (V85). A portion of this negative voltage is used as an agc source. The gain of the two r-f amplifiers (V1 and V2) is controlled by this agc voltage. The agc

voltage varies with the strength of the input signal to the receiver. As the input signal strength increases, this agc voltage increases and lowers the gain of the two r-f amplifiers.

41. First R-f Amplifier (fig. 18)

a. The r-f amplifiers amplify the f-m signal which comes from the antenna. No operational tuning of these amplifiers is provided other than the normal alinement (par. 91).

b. The first r-f amplifier (V1) uses a subminiature type 5840 tube, isolated from stray r-f by enclosure in a metal shield. This tube has an indirectly heated cathode. The heater requires 6.3 volts, a-c or d-c. The signal is fed into the grid circuit of this stage by means of a coaxial cable at connector P1. The tuned circuit, Z1, consists of coil L1 in parallel with the series combination of capacitors C1 and C2. The impedance of the coaxial cable is matched by tapping down across a portion of the tuned circuit (connecting to the junction of capacitors C1 and C2). R1 is the d-c antenna ground return resistor. R2 is the grid-leak resistor. C3 couples the signal from Z1 to the grid of V1. L2 is the r-f plate choke. C4 couples the signal from the plate to the tuned circuit (Z2) consisting of L3 and C28. L1 and L3 are slug tuned and can be varied to tune Z1 and Z2 between 152 mc and 174 mc. C12, C13, C24, and C14 are r-f bypass capacitors for the grid, filament, screen, and plate circuits, respectively. C28 is a small brass tab mounted underneath the chassis and factory adjusted so that the slug in coil assembly Z2 will adjust the frequency of the plate circuit from 152 to 174 mc. R9 is the screen grid dropping resistor. R3 and C14 are used as a plate decoupling filter.

c. An agc voltage is applied from the grid of the fifth 455-kc i-f amplifier (fig. 26) through R2 to the grid of V1. This agc voltage is a negative voltage which increases the negative bias of V1 and reduces its gain. See paragraph 53 for details of this circuit.

42. Second R-f Amplifier (fig. 18)

a. This amplifier is similar in function to the first r-f amplifier. No tuning of this amplifier is provided other than the normal alinement (par. 91).

b. The second r-f amplifier (V2) uses a subminiature type 1AD4 tube. R-f shielding is provided for the tube by a sprayed metallic coating on the outside of the glass envelope which is connected to the filament at pin 3 by a thin wire. This tube has a directly heated filament to which voltage is applied through filament chokes L5 and L14. These two chokes and r-f bypass capacitor C15 prevent stray r-f from entering the filament circuit. The

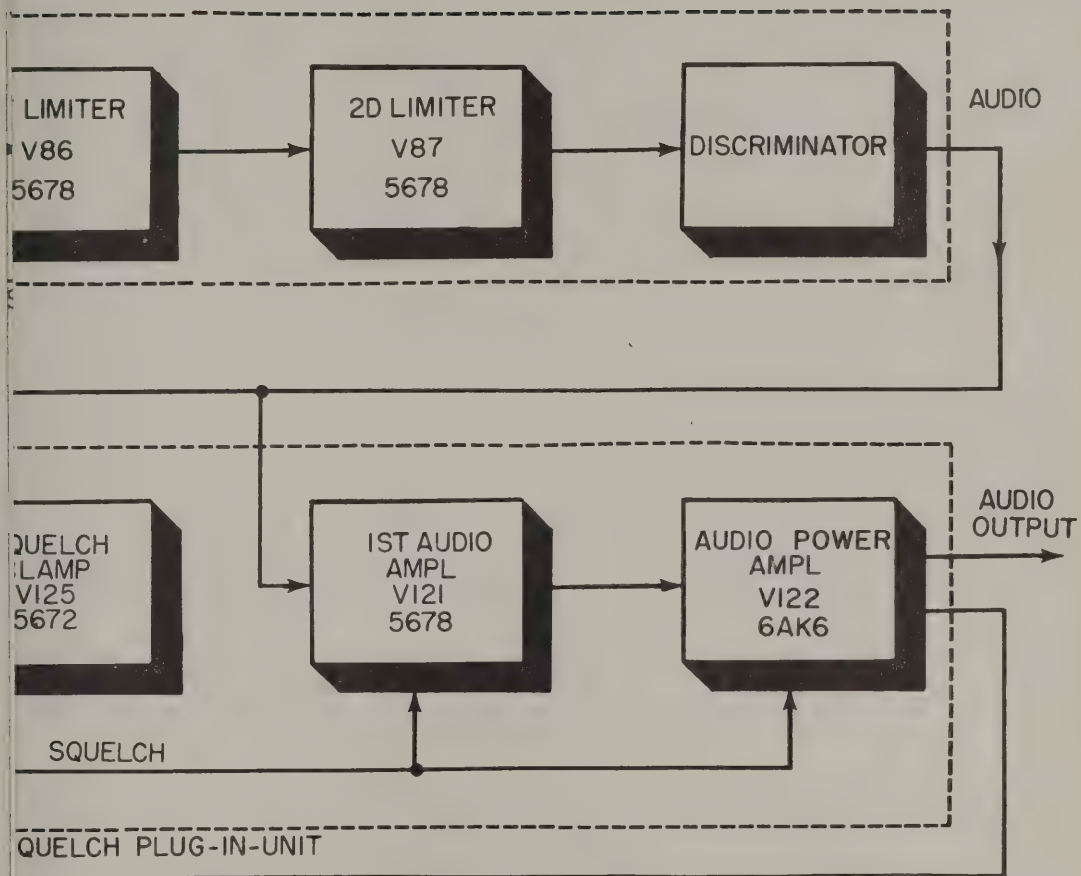
output from the first r-f amplifier is coupled to the grid of V2 through C20. Tuned circuit Z3 (L4, C5, and C6), tunes the grid circuit of this stage. C7 couples the plate output voltage to the tuned circuit of L7 and C30. The grid is connected at the junction of capacitors C5 and C6 in order to minimize the capacitive loading of V2. R4 is the grid-leak resistor. C32 is an r-f bypass capacitor for the grid circuit. L6 is an r-f plate choke. Coil assemblies Z3 and Z4 are alined to any one frequency between 152 and 174 mc. C21 couples the signal from the plate circuit of V2 to the grid of the mixer stage (V3). R10 is the screen voltage-dropping resistor. C25 is the screen bypass capacitor. R5 and C16 comprise the plate decoupling filter. C29 and C30 are small brass tabs mounted under the plug-in unit chassis and are factory adjusted to keep the frequency range of Z3 and Z4 within 152 mc to 174 mc.

c. An agc voltage is applied to the grid of V2 through R4. See paragraph 53 for details of the agc circuit.

43. First Mixer (fig. 19)

a. A signal from the LOCAL OSC 152-174 MC plug-in unit is fed into P3 and is injected at the junction of choke coil L9 and the lower side of tuned circuit Z5. L9 is a one turn coil which places the grid circuit of V4 above r-f ground to permit the oscillator voltage to be injected. This signal (7.8 mc below the r-f signal) beats with the signal coming in on the grid (pin 4) of this first mixer stage to produce sum and difference frequencies. Z6 is tuned to the difference frequency of 7.8 mc, the first intermediate frequency. Some amplification of the signal is provided by this stage.

b. The first mixer stage (V3) uses a subminiature pentode tube type 1AD4. The signal from the second r-f amplifier is coupled through C21 to the grid of this stage. Z5 is a tuned circuit which is alined to resonate at any one frequency between 152 and 174 mc. The grid of the tube is connected to the junction of C8 and C9 in such a way as to minimize the capacitive loading of the tuned circuit by the input capacity of the tube. C31 is a brass tab mounted beneath the chassis. Its function is to provide a means of adjusting the grid circuit frequency range. R11 and R7 return the grid to ground. R6 and C17 isolate the test point, marked LO, at the front of the receiver which facilitates testing and alinement. Z6 is the plate tuned circuit. Its output to plug P4 is tapped down in order to match the impedance of the coaxial cable to the following stage. R5 and C16, and R8 and C19 form a two-section decoupling filter for the screen and plate circuit. R-f coil L10 is a filament choke used with capacitors C18 and C22 to prevent stray r-f from entering the filament circuit.



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Figure 17. Radio Receiver R-394/U, block diagram.

voltage varies with the strength of the input signal to the receiver. As the input signal strength increases, this agc voltage increases and lowers the gain of the two r-f amplifiers.

41. First R-f Amplifier (fig. 18)

a. The r-f amplifiers amplify the f-m signal which comes from the antenna. No operational tuning of these amplifiers is provided other than the normal alinement (par. 91).

b. The first r-f amplifier (V1) uses a subminiature type 5840 tube, isolated from stray r-f by enclosure in a metal shield. This tube has an indirectly heated cathode. The heater requires 6.3 volts, a-c or d-c. The signal is fed into the grid circuit of this stage by means of a coaxial cable at connector P1. The tuned circuit, Z1, consists of coil L1 in parallel with the series combination of capacitors C1 and C2. The impedance of the coaxial cable is matched by tapping down across a portion of the tuned circuit (connecting to the junction of capacitors C1 and C2). R1 is the d-c antenna ground return resistor. R2 is the grid-leak resistor. C3 couples the signal from Z1 to the grid of V1. L2 is the r-f plate choke. C4 couples the signal from the plate to the tuned circuit (Z2) consisting of L3 and C28. L1 and L3 are slug tuned and can be varied to tune Z1 and Z2 between 152 mc and 174 mc. C12, C13, C24, and C14 are r-f bypass capacitors for the grid, filament, screen, and plate circuits, respectively. C28 is a small brass tab mounted underneath the chassis and factory adjusted so that the slug in coil assembly Z2 will adjust the frequency of the plate circuit from 152 to 174 mc. R9 is the screen grid dropping resistor. R3 and C14 are used as a plate decoupling filter.

c. An agc voltage is applied from the grid of the fifth 455-kc i-f amplifier (fig. 26) through R2 to the grid of V1. This agc voltage is a negative voltage which increases the negative bias of V1 and reduces its gain. See paragraph 53 for details of this circuit.

42. Second R-f Amplifier (fig. 18)

a. This amplifier is similar in function to the first r-f amplifier. No tuning of this amplifier is provided other than the normal alinement (par. 91).

b. The second r-f amplifier (V2) uses a subminiature type 1AD4 tube. R-f shielding is provided for the tube by a sprayed metallic coating on the outside of the glass envelope which is connected to the filament at pin 3 by a thin wire. This tube has a directly heated filament to which voltage is applied through filament chokes L5 and L14. These two chokes and r-f bypass capacitor C15 prevent stray r-f from entering the filament circuit. The

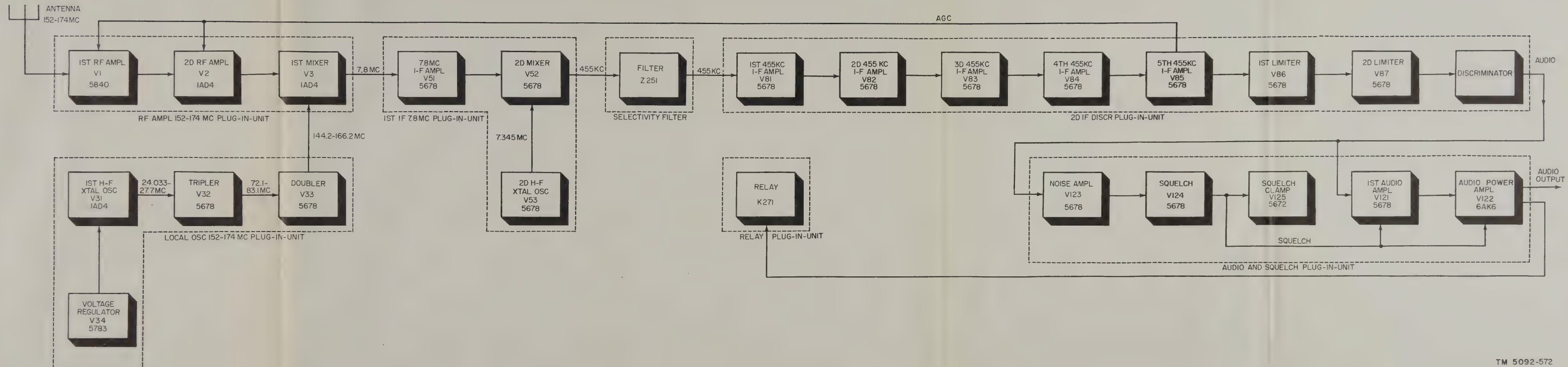
output from the first r-f amplifier is coupled to the grid of V2 through C20. Tuned circuit Z3 (L4, C5, and C6), tunes the grid circuit of this stage. C7 couples the plate output voltage to the tuned circuit of L7 and C30. The grid is connected at the junction of capacitors C5 and C6 in order to minimize the capacitive loading of V2. R4 is the grid-leak resistor. C32 is an r-f bypass capacitor for the grid circuit. L6 is an r-f plate choke. Coil assemblies Z3 and Z4 are alined to any one frequency between 152 and 174 mc. C21 couples the signal from the plate circuit of V2 to the grid of the mixer stage (V3). R10 is the screen voltage-dropping resistor. C25 is the screen bypass capacitor. R5 and C16 comprise the plate decoupling filter. C29 and C30 are small brass tabs mounted under the plug-in unit chassis and are factory adjusted to keep the frequency range of Z3 and Z4 within 152 mc to 174 mc.

c. An agc voltage is applied to the grid of V2 through R4. See paragraph 53 for details of the agc circuit.

43. First Mixer (fig. 19)

a. A signal from the LOCAL OSC 152-174 MC plug-in unit is fed into P3 and is injected at the junction of choke coil L9 and the lower side of tuned circuit Z5. L9 is a one turn coil which places the grid circuit of V4 above r-f ground to permit the oscillator voltage to be injected. This signal (7.8 mc below the r-f signal) beats with the signal coming in on the grid (pin 4) of this first mixer stage to produce sum and difference frequencies. Z6 is tuned to the difference frequency of 7.8 mc, the first intermediate frequency. Some amplification of the signal is provided by this stage.

b. The first mixer stage (V3) uses a subminiature pentode tube type 1AD4. The signal from the second r-f amplifier is coupled through C21 to the grid of this stage. Z5 is a tuned circuit which is alined to resonate at any one frequency between 152 and 174 mc. The grid of the tube is connected to the junction of C8 and C9 in such a way as to minimize the capacitive loading of the tuned circuit by the input capacity of the tube. C31 is a brass tab mounted beneath the chassis. Its function is to provide a means of adjusting the grid circuit frequency range. R11 and R7 return the grid to ground. R6 and C17 isolate the test point, marked LO, at the front of the receiver which facilitates testing and alinement. Z6 is the plate tuned circuit. Its output to plug P4 is tapped down in order to match the impedance of the coaxial cable to the following stage. R5 and C16, and R8 and C19 form a two-section decoupling filter for the screen and plate circuit. R-f coil L10 is a filament choke used with capacitors C18 and C22 to prevent stray r-f from entering the filament circuit.



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Figure 17. Radio Receiver R-394/U, block diagram.

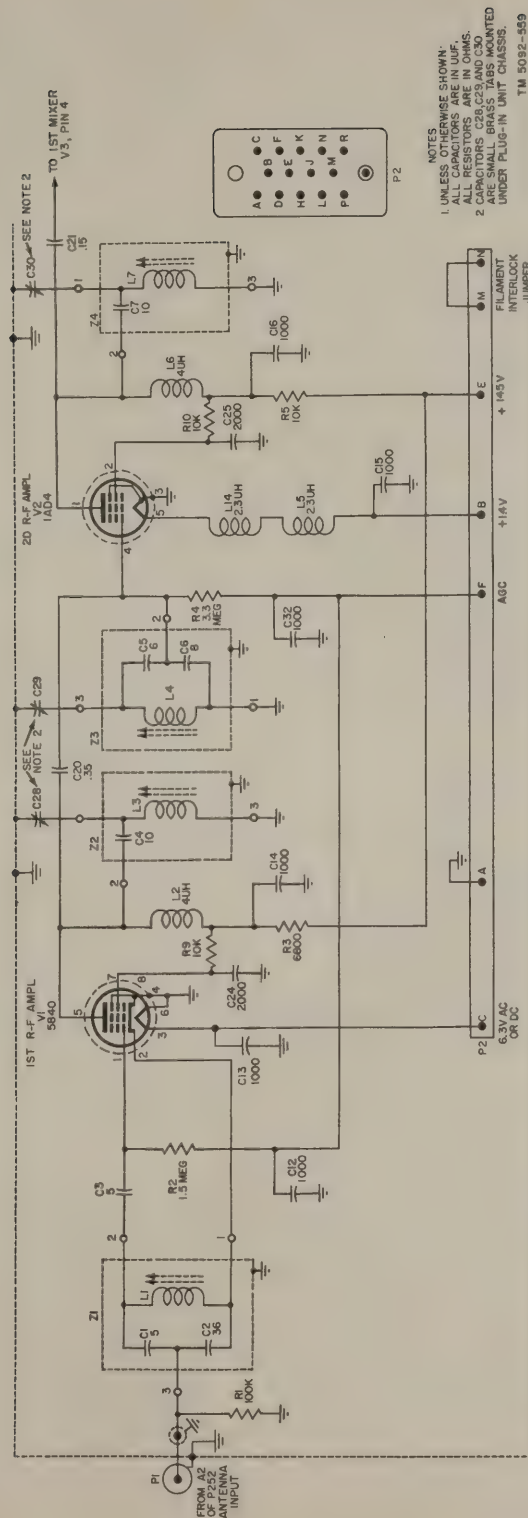


Figure 18. Radio Receiver R-394/U, first and second r-f amplifiers.

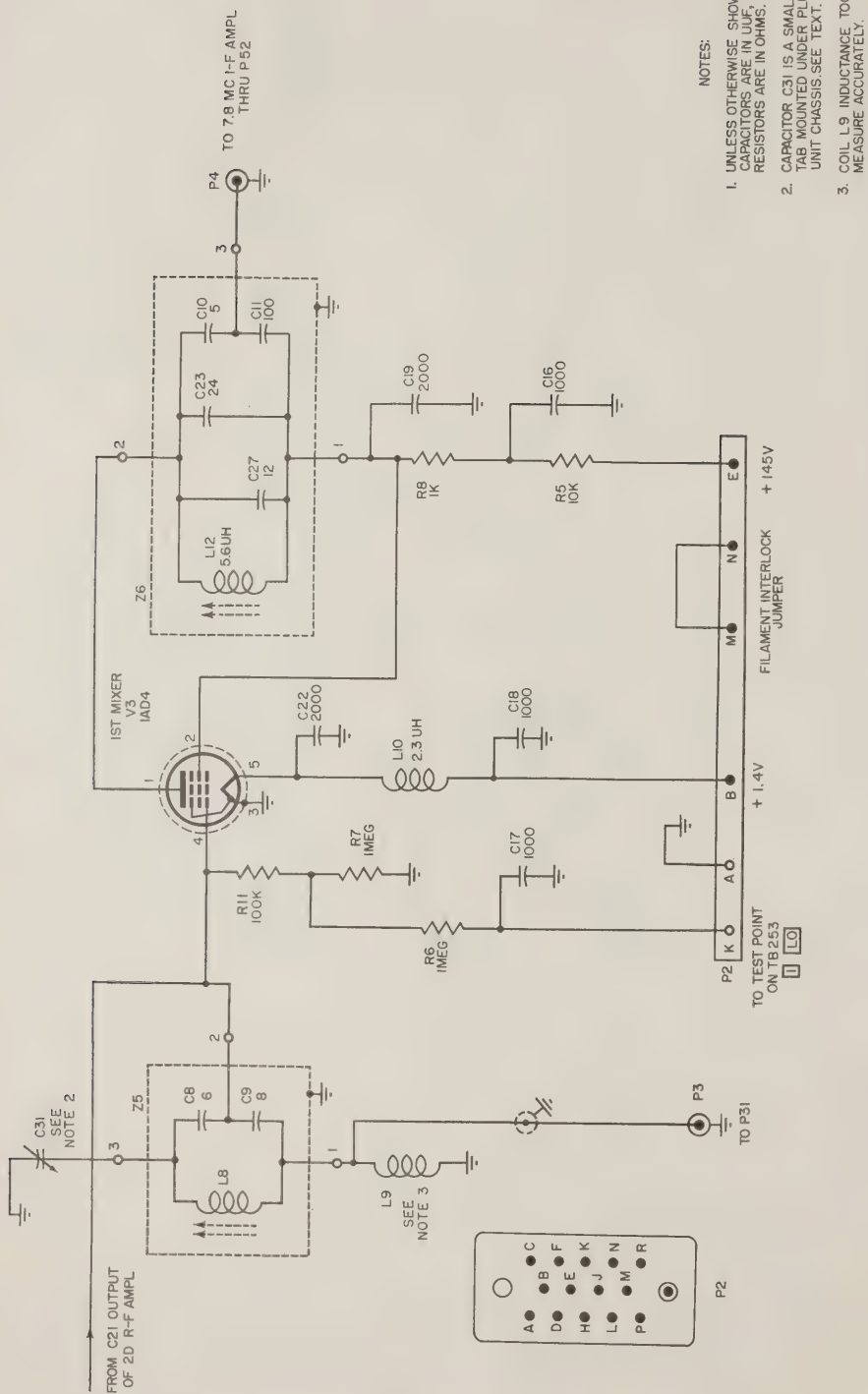


Figure 19. Radio Receiver R-394/U, first mixer.

c. The 1AD4 tube shielding, a sprayed metallic coating, is connected to the filament at pin 3 by a thin wire and is shielded from stray r-f by a tight-fitting cylindrical shield mounted on the plug-in unit chassis.

44. Local Osc. 152-174 MC Plug-in Unit (fig. 20)

The LOCAL OSC 152-174 MC plug-in unit consists of three stages. These stages are discussed in subparagraphs a through c below.

a. *First H-f Oscillator (V31)*. This stage uses a shielded subminiature type 1AD4 tube. The oscillator is a third overtone crystal-controlled oscillator. Because of the stability in frequency required, the crystal is contained in an oven which maintains a constant temperature of approximately 75° C, which is equal to 167° F. Also, to maintain stability, the screen grid voltage of the oscillator is held constant by voltage regulator tube V34. Crystal oven E31 contains crystal Y31, a heating element, and a thermostat. The heating element is operated from either 24 volts d-c or 6 volts a-c or d-c depending upon the receiver power supply being used. R-f chokes L40 and L41 and capacitors C43A and C43B are used to keep r-f voltages out of the low voltage circuits. Warping coil Z31 (with stray capacity) is in series with the crystal. This slug-tuned coil affords a means of shifting the oscillator frequency slightly in order to tune the receiver accurately to the incoming signal frequency. A test point is connected to the grid of the oscillator through isolating resistor R40. The output of the oscillator is impedance coupled to a frequency tripler stage through capacitor C34. R-f choke coils L32 and L42 and capacitors C32A, C35B, and C45 are used to keep r-f voltages out of the filament circuit. R33 is a screen grid voltage-dropping and regulation resistor. C32B and R32 make up the screen grid decoupling filter. The plate load consists of L33, across which output from the oscillator is developed. R36 and C36 comprise a plate circuit decoupling filter. C31 is a grid circuit r-f bypass capacitor for isolating test point 1. R31 functions as a grid-leak bias resistor.

b. *Tripler Stage (V32)*. This stage uses a subminiature type 5678 tube. It is an r-f amplifier whose plate circuit is slug-tuned by means of Z32 to the third harmonic of the frequency developed by the oscillator. The output from the tripler stage is coupled to the doubler stage (V33) through C38 and C39. The grid of the tripler stage is returned to ground through R35. Choke coil L34 and capacitor C35A prevent r-f from entering the filament. R37 and C37 form a decoupling filter for the plate and

screen grid. This tube is shielded by a sprayed metallic coating which is grounded through pin 3.

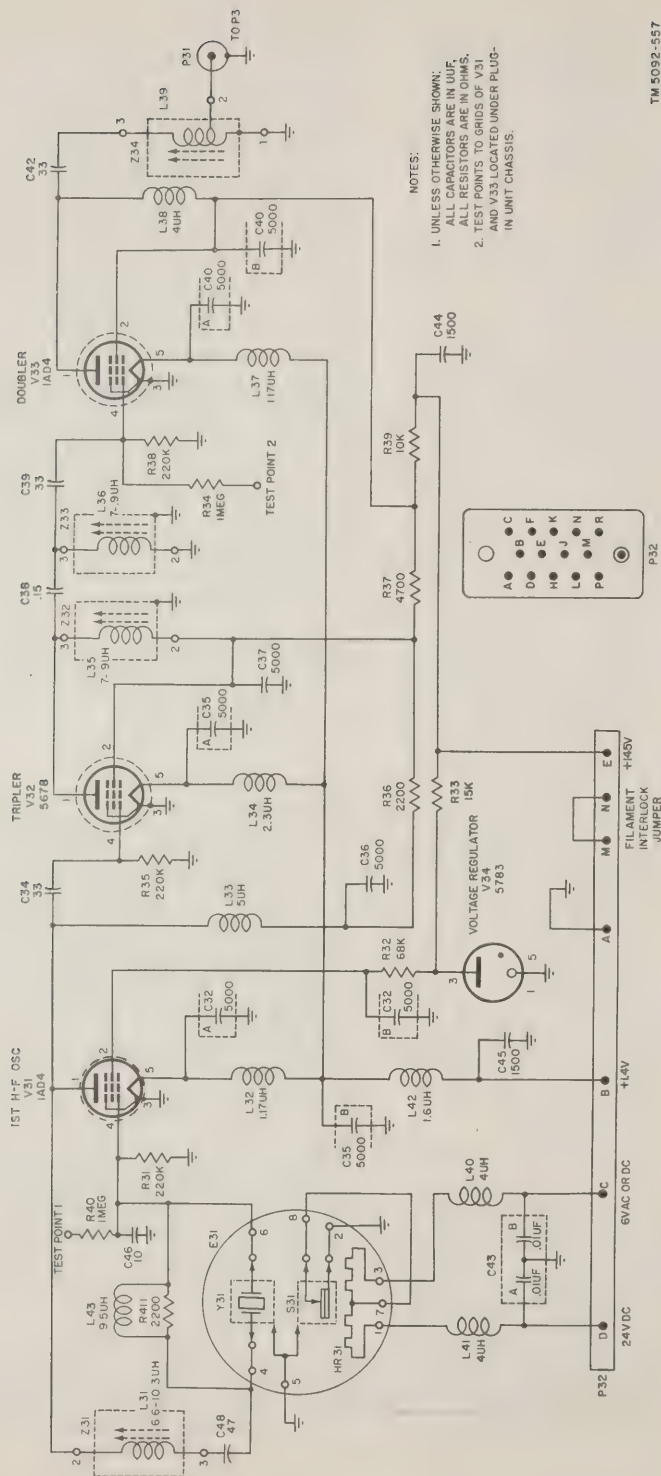
c. *Doubler Stage (V33)*. This stage uses a subminiature type 1AD4 tube. It is an r-f amplifier with a plate circuit (Z34) tuned to the second harmonic of its grid signal. The signal at the output of this stage is six times the frequency delivered by the oscillator (V31). A test point is provided which connects to the grid of this stage through isolating resistor R34. R38 returns the grid to ground. R-f choke coil L37 and C40A isolate the filament circuit for r-f. R39 and C40B constitute a plate circuit and screen grid decoupling filter. R-f choke coil L38 impedance couples the plate to Z34 through C42. L39 is so tapped down as to match the impedance of the coaxial cable terminating at plug P3, which conveys the signal to the first mixer stage, V3. Since the output from the LOCAL OSC 152-174 MC plug-in unit is mixed with the r-f signal to produce a 7.8-mc i-f frequency, the output frequency of this plug-in unit is 7.8 mc below the r-f frequency. Use this formula for determining the crystal frequency: crystal frequency (mc) = $\frac{\text{signal frequency (mc)} - 7.8 \text{ mc}}{6}$. Tube V33 is shielded from stray r-f and radiation by a sprayed metallic coating grounded to pin 3.

45. 7.8-MC I-f Amplifier (fig. 21)

The 7.8-mc i-f amplifier (V51) uses a subminiature type 5678 tube. This stage amplifies the signal from the mixer stage (V3). The grid circuit is tuned by three individual tuned circuits, Z52, Z53, and Z54 which are loosely coupled through the low-value capacitors, C58 and C60. These three tuned circuits make this stage very selective. Resistors R54, R58, and capacitors C55B, C75A, and C71 form a plate circuit decoupling filter. The filament circuit is isolated by r-f choke coils L56 and L57 and capacitors C70A and C70B. R53 is the screen voltage-dropping resistor and is bypassed by C55A. A test point connection to the grid of this stage is provided through the decoupling filter consisting of R52 and C68. This test point terminates at the front panel of the receiver and is marked RF. Output from the amplifier is connected to the second mixer through coupling capacitor C62. R51 is the grid return to ground. Tube V51 is shielded from stray r-f by a sprayed metallic coating which is grounded through a connection to pin 3.

46. Second Mixer (fig. 22)

a. The function of the second mixer (V52) is that of producing difference frequencies as a result of two signals of different frequencies being present



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Figure 20. Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit.

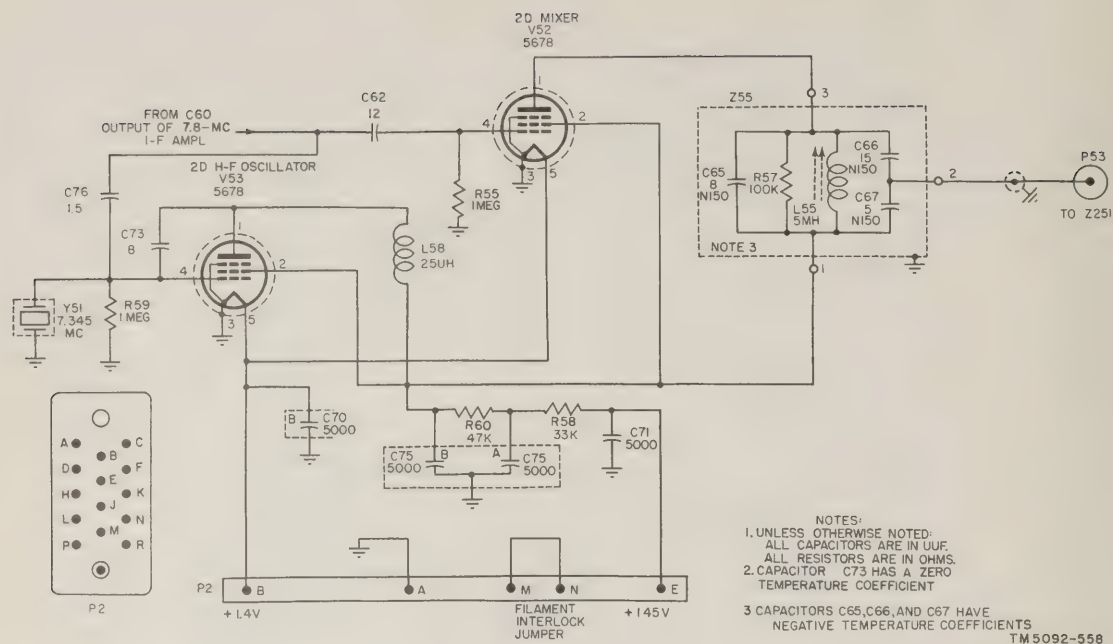


Figure 22. Radio Receiver R-394/U, second mixer and second high-frequency oscillator stages.

at its control grid. Since the plate circuit is tuned to the difference frequency of 455 kc, all other frequencies are rejected.

b. This stage uses a subminiature tube type 5678 which is shielded from stray r-f by a sprayed metallic coating. The grid of this stage receives a 7.8-mc signal from the 7.8-mc i-f amplifier (V51). R55 is the grid return to ground. The tuned circuit, Z55, contains a loading resistor (R57) which broadens the frequency response of the circuit to the desired width. The capacitors in this assembly have a negative temperature coefficient which compensates for frequency drift due to temperature changes. The 455-kc output signal from this stage is connected to plug P53 with a coaxial cable at the junction of C66 and C67. The signal from the second h-f oscillator, V53, is connected through C76 and C62 to the grid of the mixer. The value of C76 is very low (1.5 uuf) to isolate the second h-f oscillator (V53) from the i-f and mixer circuits.

47. Second H-f Oscillator (fig. 22)

a. The second h-f oscillator (V53) develops a 7.345-mc signal which beats with the 7.8-mc signal at the grid of the second mixer stage to produce a 455-kc output at the plate of the mixer.

b. The oscillator is a pentode crystal-controlled oscillator. R59 returns the control grid to ground

and also develops the grid leak bias. The tube filament is bypassed to ground by C70B. R-f coil L58 with its distributed capacitance tunes the plate circuit to a frequency slightly higher than the crystal frequency of 7.345-mc. This produces an inductive feedback voltage from plate to grid. Its phase is such as to make the circuit regenerative. C73 shunts the grid-to-plate capacitance of the tube and thus increases the positive feedback to the grid circuit required to sustain oscillation. Plate circuit decoupling is provided by resistors R58 and R60, and capacitors C71, C75A, and C75B. C76 couples the 7.345-mc signal to the grid circuit of the second mixer stage. V53 is shielded by a sprayed metallic coating which connects to ground through pin 3.

48. First 455-kc I-f Amplifier (fig. 23)

The first 455-kc i-f amplifier (V81) uses a shielded subminiature tube type 5678. This stage is a resistance-coupled amplifier with R84 as the plate load resistance. The selectivity of the 455-kc stages is increased by i-f selectivity filter Z251. This filter is permanently fastened to the receiver base and is connected with coaxial cables and connectors between the second mixer V52 and the first 455-kc i-f amplifier V81 (fig. 76). The filter is designed to appreciably attenuate frequencies which are more than 15 kc above or below 455 kc.

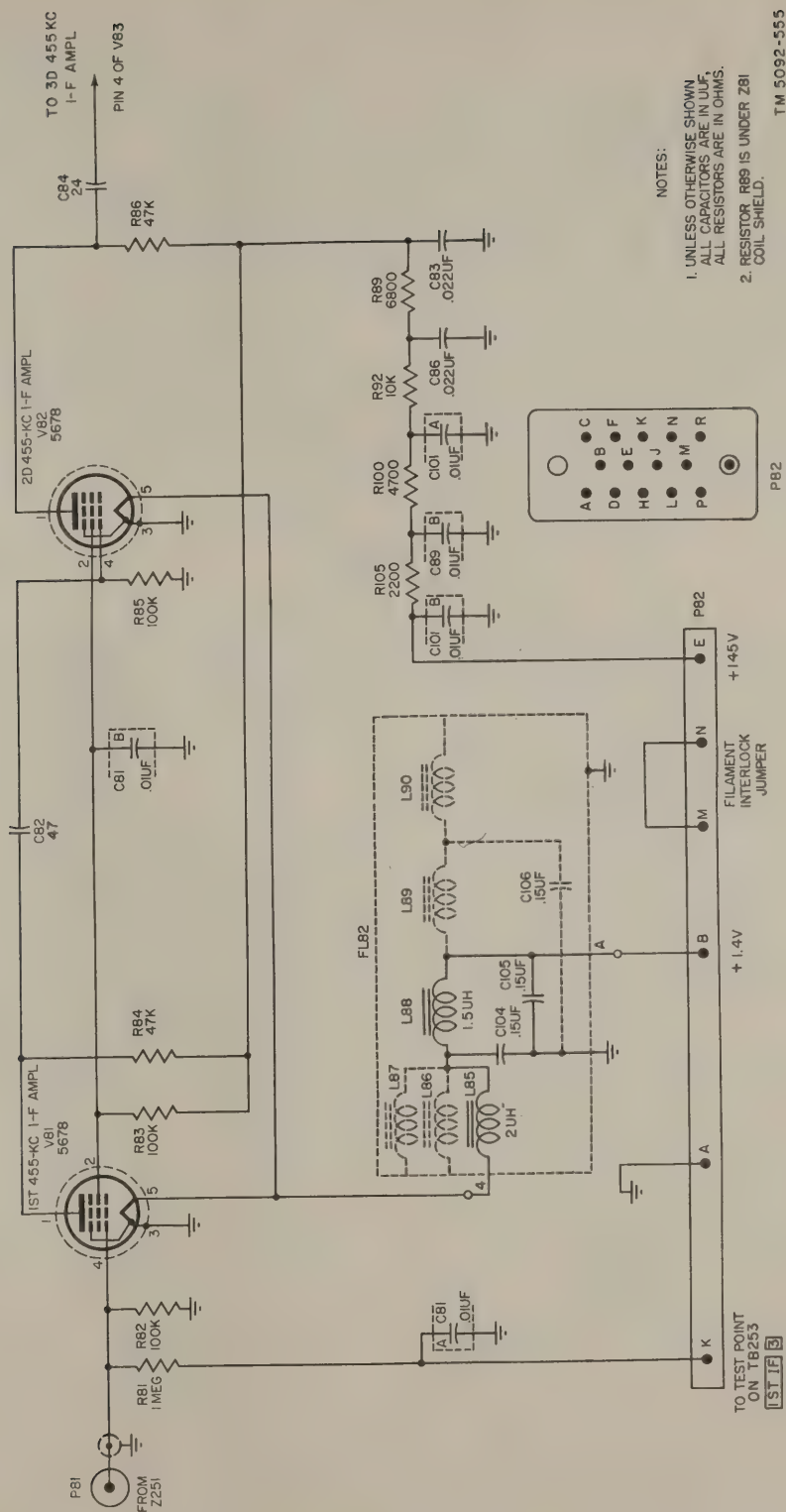


Figure 23. Radio Receiver R-394/U, first and second 455-kc i-f amplifiers.

Figure 24. Radio Receiver R-394/U, functional diagram of third and fourth 455-kc i-f amplifiers.

The unit is sealed and consists of a network of coils and capacitors. Signal input to the first 455-kc amplifier is through plug P81. A test point connection to the grid of this stage through decoupling resistor R81 can be used to measure the grid bias. It is located on the front panel of the receiver and is marked 1ST IF. C81A is an r-f bypass which forms a decoupling filter together with R81. R82 returns the grid to ground. Filament voltage is supplied through an r-f filament filter, FL82. Output to the second 455-kc i-f amplifier (V82) is coupled through C82. B+ decoupling is accomplished with resistors R89, R92, R100, R105 and capacitors C83, C86, C101A, C89B, and C101B. B+ voltage is applied through this filter to the plates and screens of the five 455-kc i-f amplifiers (V81 through V85) and the two limiter stages (V86 and V87). R83 is the screen grid voltage-dropping resistor for the first and second 455-kc i-f amplifiers (V81 and V82). C81B is an r-f bypass for both screen grids.

49. Second 455-kc I-f Amplifier (fig. 23)

This stage is similar to the first 455-kc i-f amplifier. Resistor R85 is the grid return and resistor R86 is the plate load resistor. The output voltage is applied to the third 455-kc i-f amplifier through capacitor C84.

50. Third 455-kc I-f Amplifier (fig. 24)

This stage is a shielded subminiature tube type 5678. A tuned circuit, Z81, in the plate circuit is tuned to 455 kc. Z81 consists of L81 and C87 which are loaded by R110 to broaden the frequency response. Input to the grid is supplied through C84 from the previous stage. Output to the fourth i-f amplifier (V84) is applied through C88. Filament voltage is applied through r-f filament filter FL82. Plate circuit decoupling is provided by the network of resistors R92, R100, and R105, and capacitors C89B, C101A, and C101B.

51. Fourth 455-kc I-f Amplifier (fig. 24)

The fourth 455-kc i-f amplifier, V84, uses a shielded subminiature tube type 5678. This stage is a resistance-coupled amplifier. R93 is the grid resistor, R94 is the screen voltage-dropping resistor and R95 is the plate load resistance. The filament circuit is filtered by passing the filament current through filter FL82. Plate circuit decoupling is provided by resistors R100 and R105, and capacitors C89B, C101A, and C101B. C89A bypasses the screen grid to ground. Output from this stage is coupled to the fifth 455-kc i-f amplifier through C90. R88 and R111 are part of the agc circuit and are discussed in paragraph 53.

52. Fifth 455-kc I-f Amplifier (fig. 25)

The fifth 455-kc i-f amplifier (V85) uses a shielded subminiature tube type 5678. This stage is similar to the other resistance-coupled 455-kc i-f amplifiers except that the grid-leak bias of this stage is used as an agc voltage (par. 53). R96 is the grid-leak resistor. A test point connection to the control grid is provided through isolating resistor R99. This test point (marked 2ND IF) terminates at the front panel of the receiver, and is bypassed for the intermediate frequency by C92. R94 is the screen voltage-dropping resistor and C89A is the screen bypass. R97 is the plate load resistance, across which the output voltage is developed. R100 and R105, and C101A, C89B, and C101B form a plate circuit decoupling filter. Filament current is filtered through filter FL82. See paragraph 53 for a discussion of C85, R88, and R111. Output is coupled to the control grid of first limiter V86 through C91.

53. Agc Circuit (fig. 26)

The agc circuit controls the gain of the two r-f amplifiers. A negative bias voltage, obtained from the grid-leak bias of the fifth 455-kc i-f amplifier is used to increase the negative bias of the r-f amplifiers and reduce their gain. The grid-leak bias of the fifth 455-kc i-f amplifier varies with the strength of the signal applied. Therefore, stronger applied signals produce a greater negative bias at the grid of this tube. This increased negative bias reduces the gain of the two r-f amplifiers. This prevents overloading of the r-f amplifiers. The agc circuit also makes possible more positive squelch action (par. 59). It also reduces the difference in gain among different units of Radio Receiver R-394/U and among replacement tubes in any one receiver.

a. The negative grid-leak bias of the fifth 455-kc i-f amplifier (V85) is developed across grid-leak resistor R96. The voltage at the junction of R96 and R111 has a value on the order of -5 volts. This is too large a negative voltage to apply to the grids of the r-f amplifiers. Therefore a voltage divider is set up between the screen grid of V85, which is at a potential of about +80 volts and the control grid, which is at about -5 volts with respect to ground. This voltage divider consists of R88 and R111. The values of these two resistors are such as to produce a small negative voltage (much smaller than 5 volts) at the junction of R111 and R88. This voltage is the agc voltage which is applied to the r-f amplifiers.

b. When the strength of the input signal to the receiver changes, the grid-leak bias of V85 changes. Practically the same change in voltage occurs at the junction of R111 and R88. (If an ordinary cir-

5TH 455KC. I-F AMPLIFIER
V85
5678

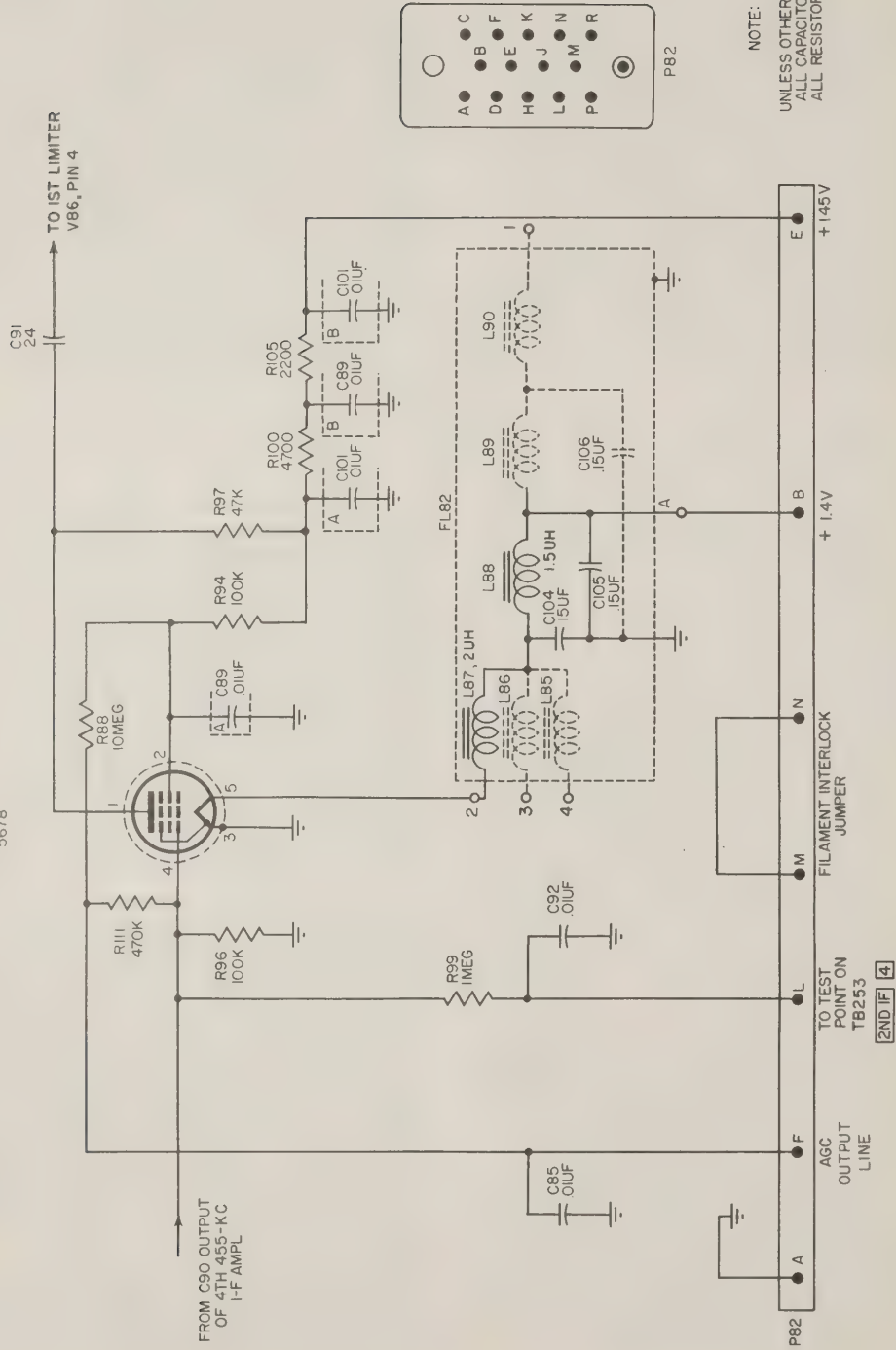
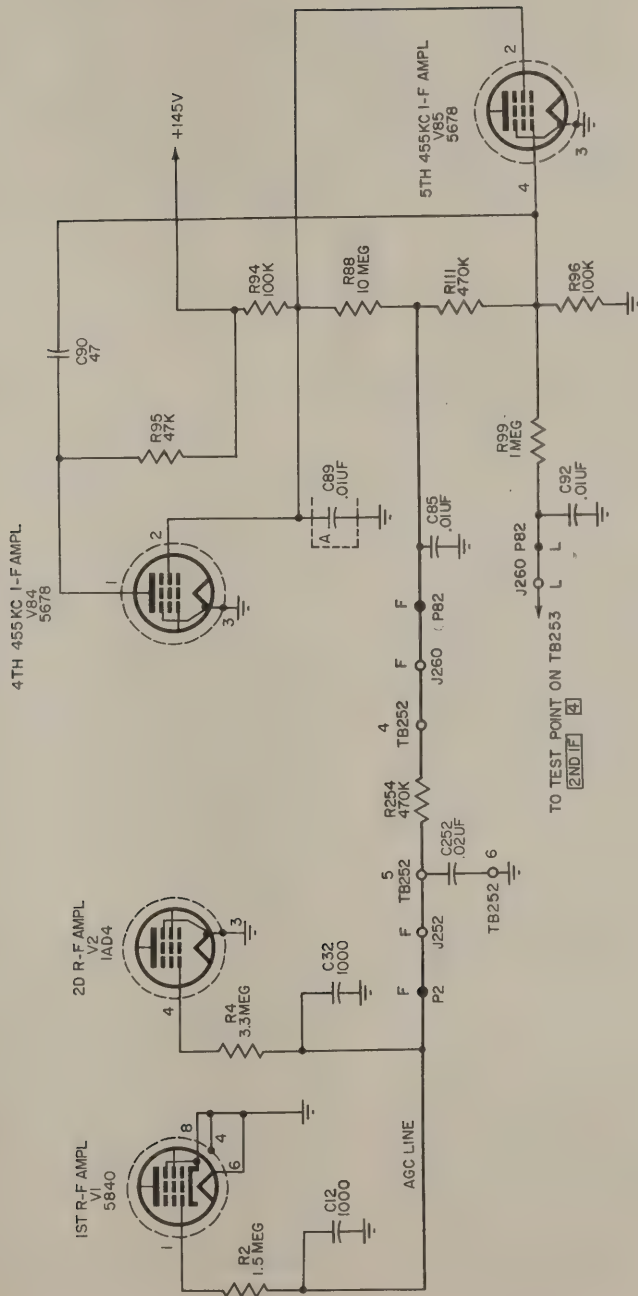


Figure 25. Radio Receiver R-394/U, fifth 455-kc i-f amplifier.



NOTE:
 UNLESS OTHERWISE SHOWN,
 ALL RESISTORS ARE IN OHMS,
 ALL CAPACITORS ARE IN UUF.
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Figure 26. Radio Receiver R 394/U, agc circuit.

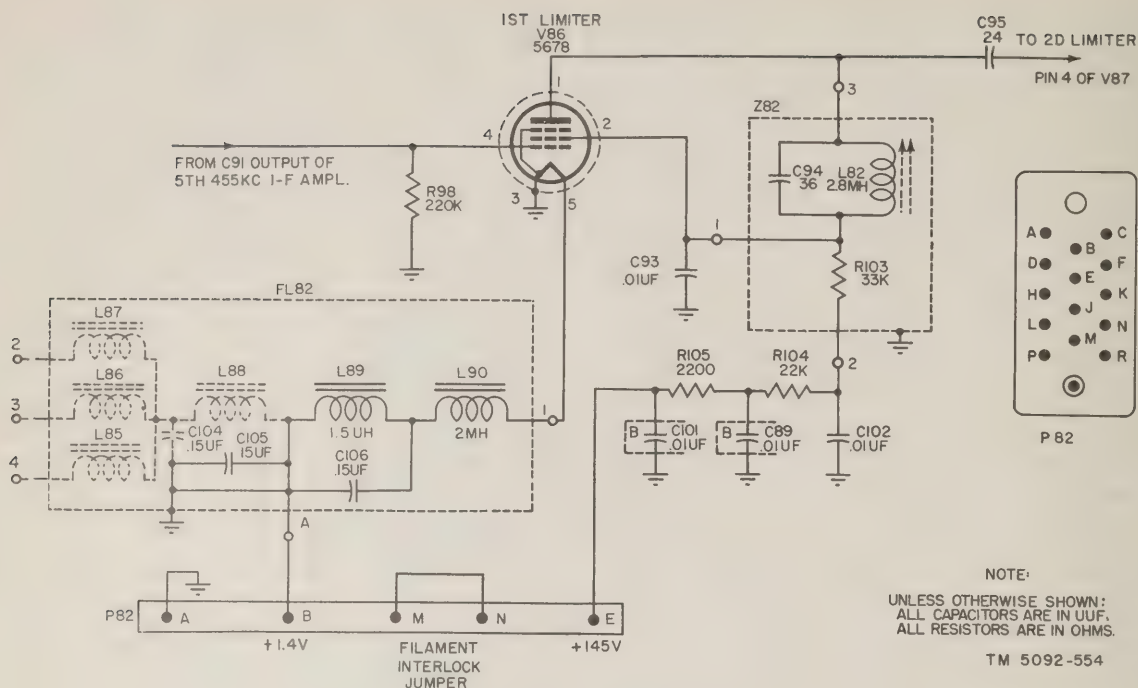


Figure 27. Radio Receiver R-394/U, first limiter.

cuit, making use of a potentiometer for R96, to reduce the agc voltage applied to the r-f amplifiers were used, only a small portion of the change is grid-leak bias across R96 would occur in the agc voltage. This would result in a weaker agc action.) The voltage at this junction is applied through a decoupling filter (C85, R254 and C252), to the grid circuits of the r-f amplifiers to control their gain. C12 and R2, and C32 and R4 are additional decoupling filters which prevent any r-f picked up in the wiring from being applied to the grids of the r-f amplifiers.

c. A test point marked 2ND IF is connected through decoupling filter C92 and R99 to the grid of V85. This test point is on the front panel of the receiver.

54. First Limiter (fig. 27)

a. The function of the first limiter stage (V86) is that of reducing or eliminating large signal amplitude variations which may be present in the output from the fifth 455-kc amplifier. Strong signals produce grid-leak bias at the grid of V86 and operate the tube near cut-off. This clips the negative half-cycles of grid voltage. The positive half-cycles operate the tube at its plate current saturation point. Thus both halves of a strong signal are

clipped and the a-c output of this tube has almost a constant amplitude. Weak signals are amplified.

b. Filament current is filtered by filament filter FL82. Grid bias is developed across grid-leak resistor R98. Resistors R103, R104, and R105 and their bypass capacitors C93, C89B, C101B, and C102 decouple the plate circuit from the B+ supply. Z82, the plate load, is resonant at 455 kc. The signal output is coupled to the second limiter through coupling capacitor C95.

55. Second Limiter (fig. 28)

a. The second limiter (V87) uses a shielded subminiature pentode tube type 5678. Its function is similar to that of the first limiter, V86. It removes any amplitude variations in signal that were not completely eliminated by the first limiter stage. This limiting action occurs because of a high negative grid leak bias and low plate and screen voltages. When the control grid swings into a negative cycle the plate current cuts off, and when the grid swings positive, plate current saturation results, thus limiting the positive and negative peaks of output voltage.

b. Output from the first limiter (V86) is applied to the grid of the second limiter. A high grid-leak

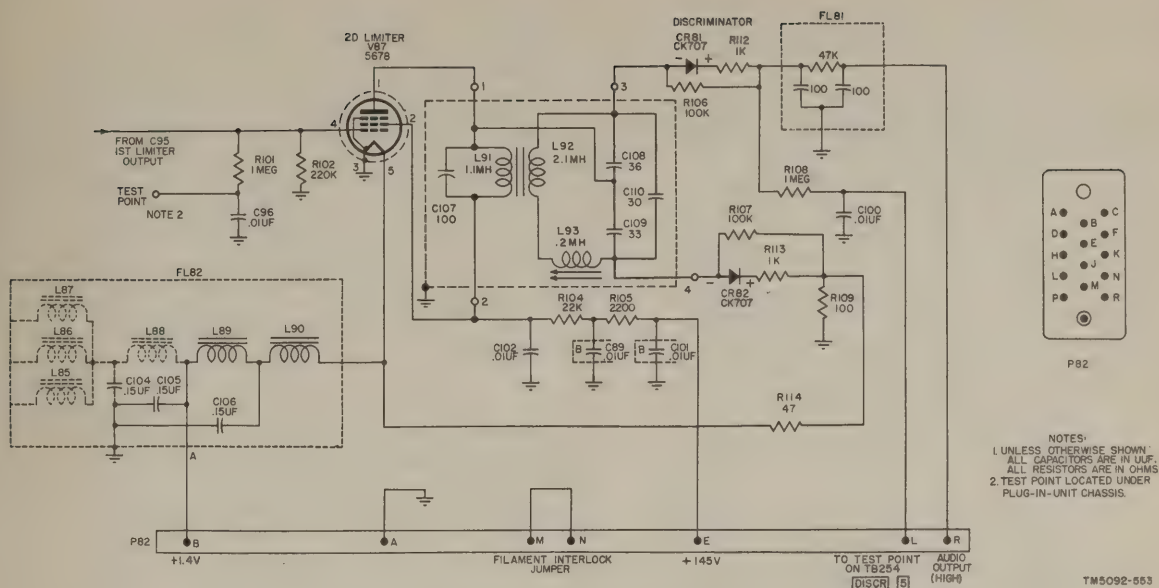


Figure 28. Second limiter and discriminator.

bias is developed across grid-leak resistor R102. A connection to the grid through isolating filter R101 and C96 is available as a limiter grid bias test point. This test point is located on the 2ND IF DISCR plug-in chassis. Filament current is supplied through FL82. Screen and plate voltages are supplied from the B+ supply through a double pi-section filter consisting of C101B, R105, C89B, R104, and C102. The connection to the plate is through the primary circuit of T81. T81 is the discriminator transformer assembly. Details of this circuit are described in paragraph 56.

56. Discriminator

a. General. The discriminator is a modified Foster-Seely circuit which consists of transformer assembly T81, two germanium diode rectifiers, CR81 and CR82, and associated resistors and capacitors. It converts the f-m output signal of second limiter V87 to an audio signal. The f-m signal from the second limiter has a center frequency of 455 kc and varies above and below this frequency at the rate of the audio signal by which it is modulated. The maximum deviation from the center frequency is ± 15 kc. The primary and secondary circuits of T81 are tuned to 455 kc and have a band pass of ± 38 kc. This excess width produces a flat response of both tuned circuits to signals with a frequency of 455 kc ± 15 kc.

b. Circuit Analysis (fig. 28). The input signal to the discriminator is applied across the primary circuit of T81 and to the junction of C108 and C109 in the secondary circuit of T81. The voltage across L91

produces a current through L91 which induces a voltage in L92 which is in phase with the voltage applied to the primary circuit (L91). (The induced voltage across the secondary of a transformer is either in phase or 180° out of phase with the primary voltage depending on the relationship of the two coil windings.) The induced voltage across L92, E_s , produces a current, I_s , through the tuned secondary circuit (a series resonant circuit) which is in phase with the induced voltage across L92 at the center frequency (455 kc), which lags the induced voltage at frequencies above the center frequency, and which leads the induced voltage at frequencies below the center frequency. Since the induced voltage across L92 is in phase with the primary voltage, the current in the secondary circuit has the same phase relationship to the primary voltage as it does to the induced secondary voltage.

c. I-f Voltage at CR81 and CR82 (figs. 28 and 29). The i-f voltage at CR81 is equal to the vector sum of two voltages in series. The first is the voltage applied directly to the junction of C108 and C109. The second is the voltage developed across C108 by the current, I_s , flowing through this capacitor. Similarly, the voltage at CR82 is equal to the vector sum of the voltage applied to the junction of C108 and C109, and the voltage developed across C109 by the current, I_s , flowing through this capacitor. The voltage across a capacitor lags the current flowing through it by 90°.

- (1) At the center frequency, when the current, I_s , is in phase with the applied voltage, the voltage across C108 lags the applied volt-

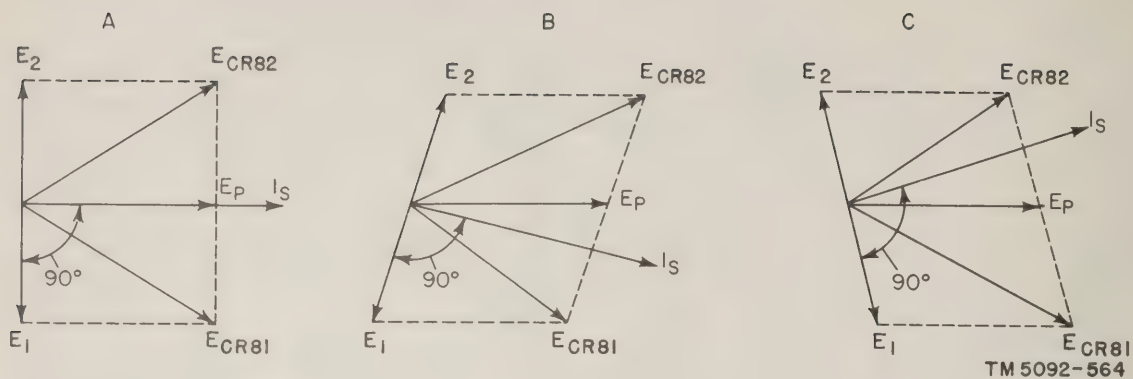


Figure 29. Radio Receiver R-394/U, discriminator vector diagrams.

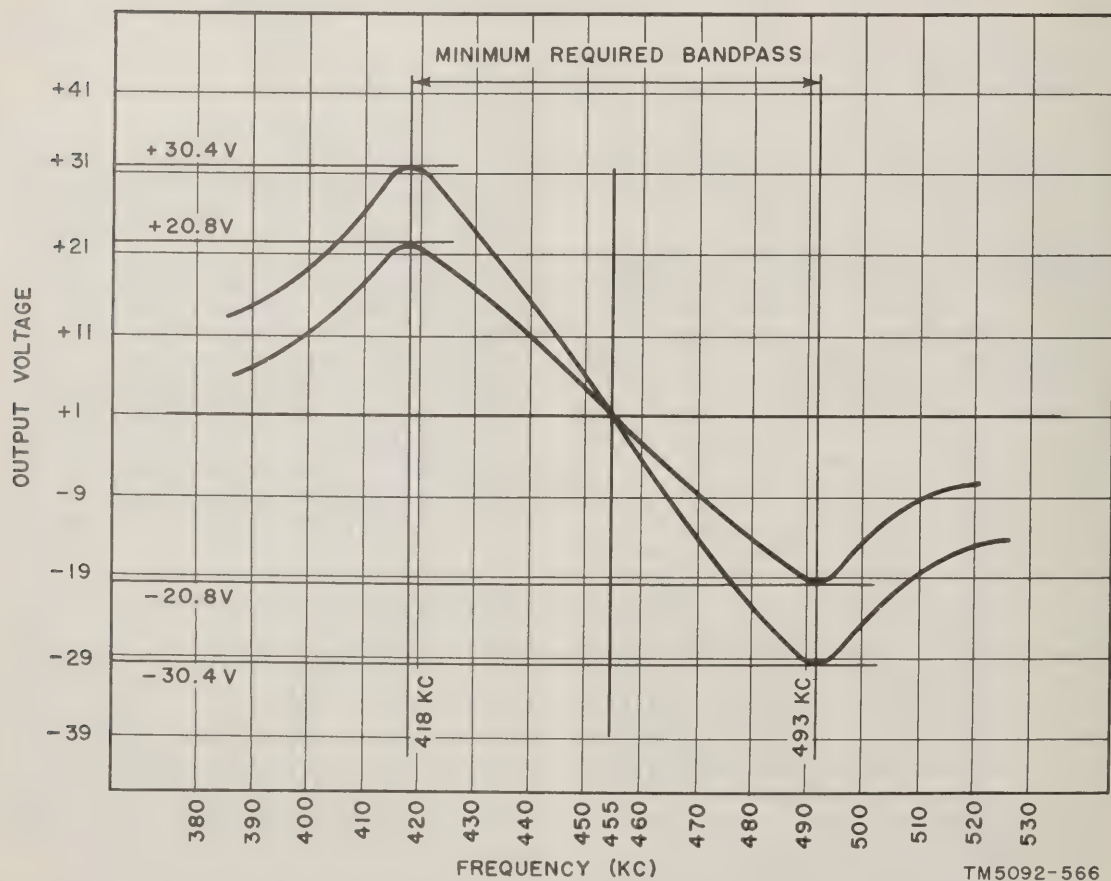


Figure 30. Radio Receiver R-394/U, discriminator response curve.

age, E_p (voltage at the junction of C108 and C109) by 90° . The vector sum of the applied voltage, E_p , and the voltage across C108, E_1 , is shown on A, figure 29, and is represented by the resultant vector, E_{CR81} . To obtain the voltage at CR82, it is necessary to add vectorially the voltage across C109, E_2 , to the applied voltage, E_p , in the opposite sense from that of C108. Therefore, on A, figure 29, E_2 is drawn straight up, and is 180° out of phase with E_1 . The resultant vector, E_{CR82} , represents the voltage at CR82. Although both resultant voltages differ in phase, their magnitudes are equal.

- (2) When the applied voltage is above the center frequency, the current, I_s , through the secondary circuit lags the applied voltage. In B, figure 29, E_1 is shown lagging I_s by 90° and E_2 is shown leading I_s by 90° . In this case it is apparent that the i-f voltage at CR82 is greater than that at CR81.
- (3) When the applied voltage is below the center frequency, the current, I_s , through the secondary circuit leads the applied voltage, E_p . In C, figure 29, E_1 is again shown lagging I_s by 90° and E_2 is shown leading I_s by 90° . In this case it is apparent that the i-f voltage at CR81 is greater than that at CR82.

d. Output Voltage of Discriminator. The output of the discriminator is at terminal R of P82 (fig. 28). When there is no discriminator output, this point is at a potential of approximately +1 volt. This is the potential across R109, obtained from the 1.4-volt filament supply through voltage-dropping resistor R47. This low positive voltage provides a bias to CR82 and prevents low hum voltages from entering the discriminator circuit. Since the output of the discriminator is applied to first audio amplifier V121 and to noise amplifier V123 through coupling capacitors, this d-c voltage has no effect on these stages. Only changes in the d-c discriminator output which occur at an audio rate are passed to these stages.

- (1) When the i-f signal applied to the discriminator is at the center frequency (455 kc), the voltages at CR81 and CR82 are equal, and equal d-c voltages are developed across R106 and R107. These two voltages, which are connected through L92 and L93, are series opposing. Therefore, the d-c output of the discriminator remains unchanged.
- (2) When the i-f signal applied to the discriminator is above the center frequency, the voltage at CR82 exceeds that at CR81 and the d-c voltage across R107 exceeds that

across R106. This causes the d-c output of the discriminator to drop.

- (3) When the i-f signal applied to the discriminator is below the center frequency, the voltage at CR81 exceeds that at CR82 and the d-c output across R106 exceeds that across R107. This causes the d-c output of the discriminator to rise.
- (4) Since the frequency of the i-f signal varies at an audio rate, the d-c output of the discriminator varies at an audio rate. I-f voltages are bypassed to ground by i-f filter FL81. The instantaneous d-c output of the discriminator (discriminator frequency response curves) is shown on figure 30. The two curves indicate the tolerance limits for a satisfactory discriminator.

e. Miscellaneous. L93, located in the secondary of T81, is adjustable for tuning the discriminator circuit to the i-f center frequency. R112 and R113 are balancing resistors which equalize the forward resistance of the CR81 and CR82 circuits. R108 and C100 form a decoupling filter for the test point on the front of the receiver marked DISCR 5. A meter at this point can be used to measure either a fixed d-c output (if a fixed frequency is applied to the receiver) or an audio output (if an f-m signal is applied to the receiver).

57. First Audio Amplifier (fig. 31)

The first audio amplifier (V121) uses a shielded subminiature type 5678 tube. This stage amplifies the audio output of the discriminator. Input is applied through a de-emphasis network which consists of R121, R124, C121, C122, and C124. The de-emphasis network attenuates the higher audio frequencies. The grid circuit is returned through R122 and R128, to the junction between R144 and R145 in the squelch circuit (fig. 32). (Ground potential is at some point within R144.) R128 and C123 are a decoupling filter between the squelch and first audio circuits. It is from this point that bias is applied to both audio amplifiers. (See par. 59 for squelch circuit operation.) Output from the first audio amplifier is coupled through C126 to a potentiometer (R127) which controls the voltage input to the audio power amplifier (V122). C122 is an audio coupling capacitor. C123 and R124 decouple the grid from a-f (audio-frequency) voltages developed in the squelch circuit or in the wiring. R123 and R124 shunt the filament to reduce its current to the desired value. R-f filament choke coil L212 prevents r-f from getting into the filament circuit. Resistor R125 and capacitor C125 are the screen dropping resistor and screen grid bypass, respectively. R126 is the plate load resistor, across which the amplified

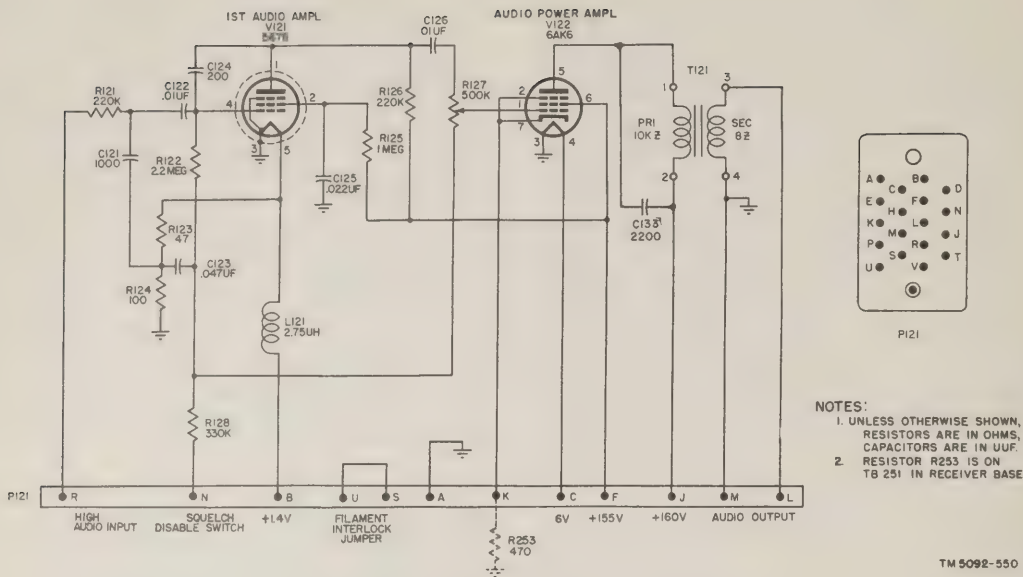


Figure 31. Radio Receiver R-394/U, first audio and audio power amplifiers.

audio output is developed. Inverse feedback from plate to grid is provided through C124. This capacitance offers a greater impedance to the lower audio frequencies than to the higher audio frequencies. Therefore the high a-f feedback voltage is greater. This causes the high-frequency audio output of the amplifier to be attenuated much more than the low-frequency audio output. The high-frequency de-emphasis produced by the input circuit to the grid of this stage is increased by the action of this circuit.

58. Audio Power Amplifier (fig. 31)

The audio power amplifier (V122) uses a miniature type 6AK6 tube. This stage supplies audio power to a handset or to a loudspeaker in a control unit. The grid of this tube is connected to the movable contact of volume control R127 which has a slotted shaft for screwdriver adjustment. Adjustment of the control presets the audio output of the receiver. Output voltage is coupled through output matching transformer T121 to a speaker or handset. Capacitor C133 is connected across the primary of transformer T121 to bypass the unwanted higher frequency audio signals. The grid return is through R127 and R128 to the junction of R144 and R145 in the squelch circuit. (See par. 59 for squelch circuit operation.) When the SQUELCH disable switch is in the OFF position, this grid return point is grounded, thus allowing the two audio amplifier stages to operate regardless of the action of the squelch circuit. Higher plate and

screen voltages are supplied to this stage than to the previous stages in order to obtain a high audio power output.

59. Squelch Circuit (fig. 32)

a. A squelch circuit is used for the purpose of silencing the rushing noise heard in an f-m receiver when a signal is not being received. The squelch circuit used in this receiver disables the audio amplifier tubes, V121 and V122, by biasing these tubes beyond cutoff during no signal input periods.

b. The audio output of the discriminator is applied to noise amplifier V123 through a high-pass filter consisting of C127 and R129 and C128 and R130. This two-section filter rejects audio frequencies (below 5,000 cps) but passes noise frequencies (5,000 to 15,000 cps). C129 couples the noise signals to the grid of V123. When a signal is being received by the receiver, an agc voltage is developed at the grid of the fifth 455-kc i-f amplifier (par. 53). This agc voltage is fed back to the grids of the first and second r-f amplifiers and reduces their gain. The reduced gain of the r-f amplifiers keeps the noise voltage down to a point below that necessary to operate the squelch circuit and squelch the receiver. When no signal is received by the receiver, there is no agc voltage and the r-f amplifiers operate at full gain. This increased amplification results in noise voltages

large enough to operate the squelch circuit and squelch the receiver.

c. When the receiver is not squelched, there is a low positive voltage at the grid of V123. This voltage is obtained from a voltage divider consisting of R252 and R2408, which are in series with the 145-volt supply and another voltage divider consisting of R136 and CR121, in parallel with R2408. CR121 offers a low resistance to electron flow in the direction from ground through it to R136. Therefore, the positive voltage across this rectifier is low. It is this low positive voltage that is applied to the grid of V123 when no noise signal (or a very weak one) is applied. R2408, the SQUELCH control, may be varied (by panel control) to increase or decrease the value of this low positive voltage. The higher this positive voltage is, the greater will be the noise voltage required to squelch the receiver and the lower will be the signal voltage required to unsquelch the receiver. This control, therefore, determines the squelch threshold level.

d. When no signal is being received by the receiver, noise voltages are amplified sufficiently by the two r-f amplifiers and the succeeding stages in the receiver to operate the squelch circuit. The noise voltage passes through the high-pass filter in the grid circuit of V123 and develops a negative grid-leak bias at the grid of this tube. The amplified noise output at the plate of this tube is fed back through C131 to the junction of R136 and R135 in the grid circuit. CR121 shunt rectifies this a-c signal, offering very little resistance to the positive half-cycles of signal which are applied across it from C131 but offering a very high resistance to the negative half-cycles. This results in a rectified negative voltage across CR121 which increases the negative bias on the grid of V123. With a high negative bias on V123, the d-c plate current of this tube is greatly reduced and the d-c plate voltage rises sharply.

e. Before the application of the noise signal to V123, V124 is biased to cutoff (through R147 and R139) by the -40-volt supply. The sharp rise in voltage at the plate of V123 raises the voltage at the grid of V124 and this tube now conducts. Conduction of V124 causes a drop in its plate voltage because of the voltage drop through R142.

f. A voltage divider exists between the plate of V124 (junction of R142 and R143) and the -40-volt supply. This divider consists of R143, R144, and R145. The values of these three resistors are such as to produce a very low negative voltage (with respect to ground) at the junction of R144 and R145 when the receiver is not squelched. It is this voltage that is applied to the grids of the two audio amplifiers, V121 and V122, and normally allows them to operate. However, the drop in plate voltage of V124 (subpar. e above) causes a drop in voltage at the junction of R144 and R145. This drop

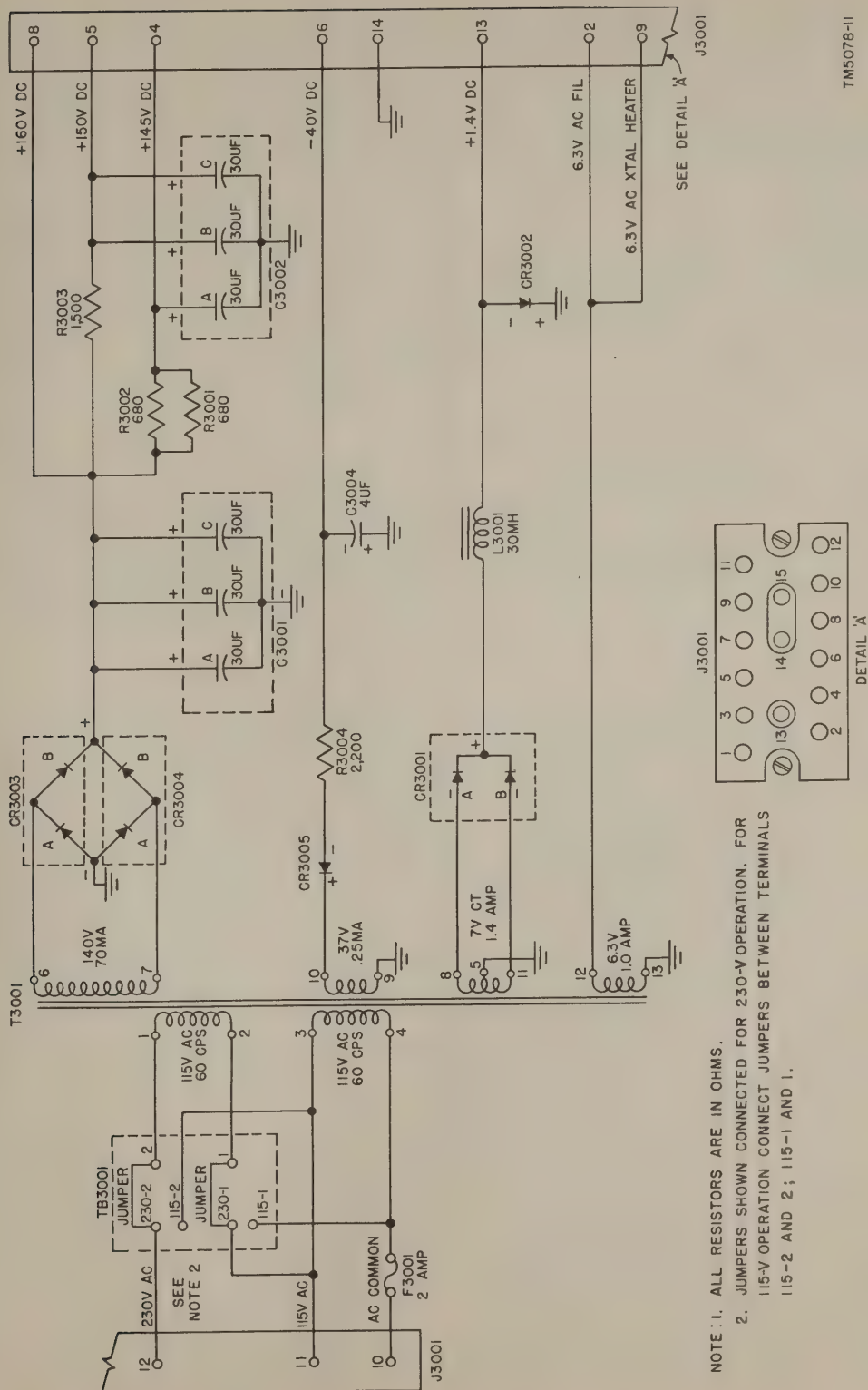
in voltage is sufficient to bias the two audio amplifiers beyond cutoff and all sound output from the receiver is squelched.

g. A drop in voltage is also produced at the grid of squelch clamp tube V125. This tube (which was normally conducting) is now biased close to cutoff. This raises its d-c plate voltage. This rise in voltage is also across the voltage divider consisting of R146 and R147 and raises the voltage at the junction of these two resistors. This rise in voltage is applied through R139 to the grid of V124 to reinforce the action of V123 in raising the grid bias of V124 and causing it to conduct. This action assures a sufficient drop in voltage at the plate of V124 to squelch the two audio amplifiers. More positive squelch action is thus provided by this stage.

b. When a signal is received by the receiver, a considerable agc voltage is developed at the fifth 455-kc i-f amplifier. The agc voltage is fed back to the two r-f amplifiers and reduces their gain. Therefore, very little noise voltage is applied to the squelch circuit. The negative bias at the grid of V124 leaks off and the low positive voltage that was originally present before the application of the noise signal is again applied to the grid of this tube. The plate current increases and the plate voltage drops. The drop in plate voltage produces a drop in the grid voltage of V124 and the plate current of this tube again is cut off. This causes a rise in its plate voltage and a rise in the voltage at the junction of R144 and R145. The rise in voltage at this junction is applied to the grids of the two audio amplifiers and allows them to conduct and operate. The rise in voltage at the plate of V124 also produces a rise in voltage at the grid of V125 (squelch clamp tube). This increases the plate current of this tube and causes a drop in its plate voltage. This drop in plate voltage produces (through R146 and R139) a further drop in the voltage at the grid of V124 and assures that this tube will remain cut off.

i. A squelch disable switch (S2402) is connected between the junction of R145 and R144 and ground. When the SQUELCH control is in its extreme clockwise position, this switch is closed. This action keeps the junction of R144 and R145 at ground potential regardless of any action of the squelch circuit. Therefore the audio amplifiers, which obtain their grid bias voltage from this point, cannot be cut off and the receiver will not be squelched.

j. A muting circuit is provided through a connection from terminal T of P121. In some radio sets in which Radio Receiver R-394/U is used with an associated transmitter, it sometimes is desired that the receiver be muted (silenced) while the transmitter is being operated. To accomplish this, a +90-volt potential is supplied to terminal T of P121 from the transmitter. This potential, applied



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Figure 33. Power Supply PP-486/U, schematic diagram.

through a voltage divider consisting of R148, R139, and R147, raises the voltage at the grid of V124 and causes the tube to conduct. This produces a drop in voltage at the plate of V124 (and at the junction of R144 and R145) similar to the drop that occurs when squelch action (due to noise) takes place. The audio amplifiers are therefore biased beyond cutoff and the receiver is muted (silenced).

60. Power Supplies

a. The power supply referred to in this instruction book is the 115- or 230-volt a-c Power Supply PP-846/U. This power supply is furnished with Radio Receiving Set AN/FRR-36. Below is a listing of this and the other power supplies which are used with Radio Receiver R-394/U.

Power Supply PP-846/U (115- or 230-volt a-c input).

Power Supply PP-867/U (24-volt d-c input).

Power Supply PP-868/U (12-volt d-c input).

Power Supply PP-869/U (6-volt d-c input).

b. These four power supplies are interchangeable, the selection depending on the power source available and the radio set being used. Plug P251 in

the receiver base connects to the jack in the power supply.

c. Power Supply PP-846/U is powered by a 115- or 230-volt a-c, 50- to 65-cycle power source. The power transformer has two primary windings which are connected in parallel (properly phased) for 115-volt a-c use, and in series (properly phased) for 230-volt a-c use. The 1.4 volt d-c filament power is rectified and regulated by three selenium rectifiers. The plate supply is rectified (full-wave) by selenium rectifiers, connected in a bridge circuit. The negative 40-volt d-c supply is rectified by a selenium rectifier connected for half-wave operation. The two tubes in the receiver with 6.3-volt filaments are supplied by a 6.3-volt a-c winding on the power transformer. This winding also supplies power to the heater in crystal oven E31.

61. Relay Adaptation in Radio Receiver R-394/U

Radio Receiver R-394/U normally employs a 470-ohm resistor, R253, as the cathode bias resistance of audio power amplifier V122. An alternate circuit is through relay K271, which has a 500-ohm coil. It is substituted for the cathode

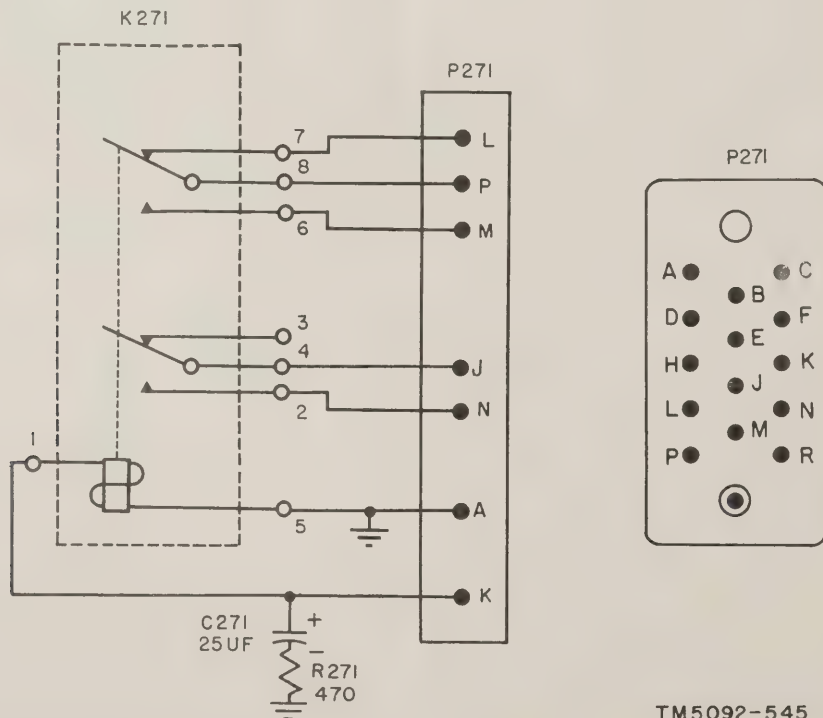


Figure 34. Radio Receiver R-394/U, schematic diagram of RELAY plug-in unit.

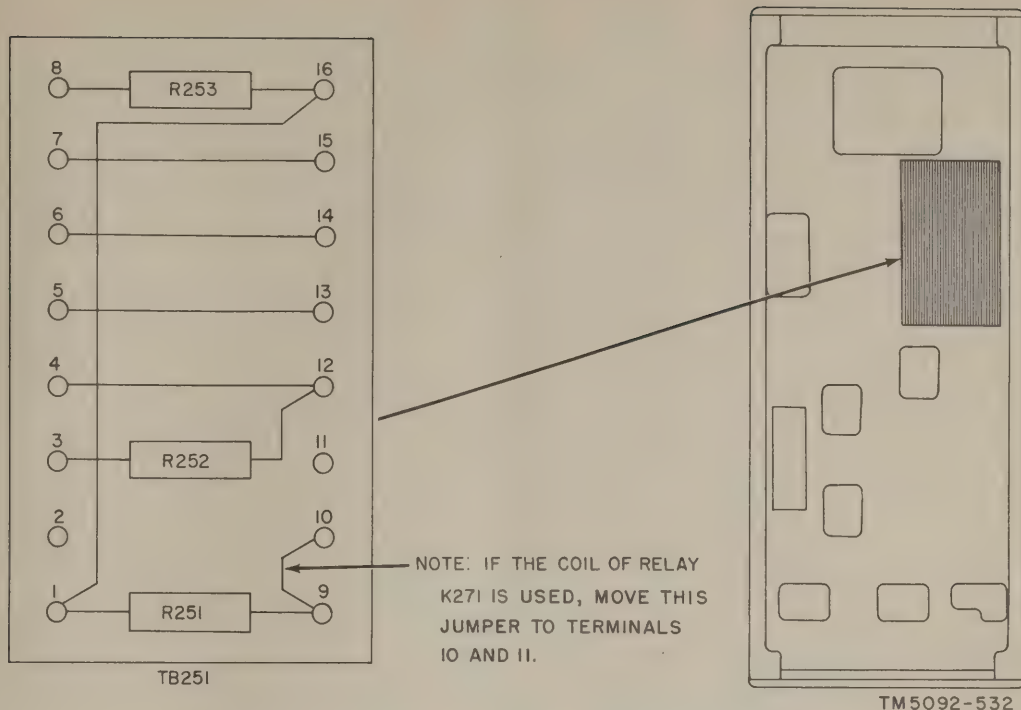


Figure 35. Radio Receiver R-394/U, showing jumper connections on RELAY plug-in unit.

bias resistance (R253) of this stage when the jumper is removed from terminals 9 and 10 of TB251 and connected across terminals 10 and 11 (figs. 35 and 76). This relay in Radio Receiver R-394/U can be used to control a transmitter for retransmission, or it can be used as a signaling device, which notifies the operator when a signal is being received. The relay coil is bypassed for audio with the series combination of 25-uf (microfarad) capacitor (C271) and a 470 ohm resistor (R271) so that a controlled amount of degeneration in the cathode circuit will occur. This causes the audio output of the receiver to be approximately the same with the relay unit as it is when resistor R253 is used for cathode bias. Relay K271 is energized when the audio power amplifier V122 draws more than 9 ma (milliamperes) of current.

62. Receiver Base (fig. 36)

a. General. The receiver base of Radio Receiver R-394/U contains six connectors which accommodate the various plug-in units. It also contains selectivity filter Z251, filament filter Z252, main receiver connector P252, power supply connector P251, eight test jacks which terminate at the front of the receiver, and two terminal boards.

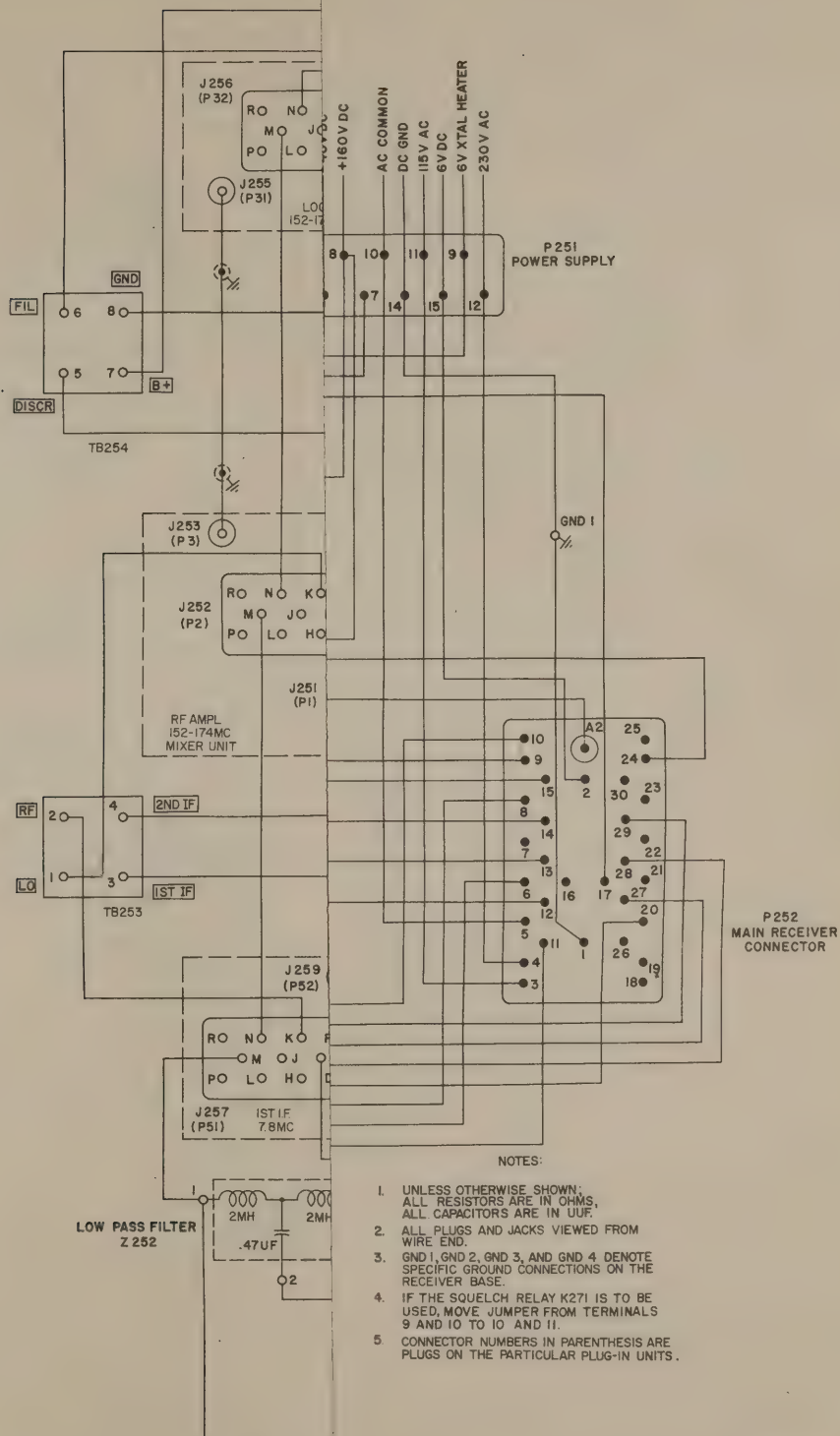
b. Plug P252. This plug provides a connection from the receiver to the radio set case. Various volt-

ages and signals are routed through this plug, to the SQUELCH control, audio output, antenna input, squelch relay contacts, and power input to the power supply.

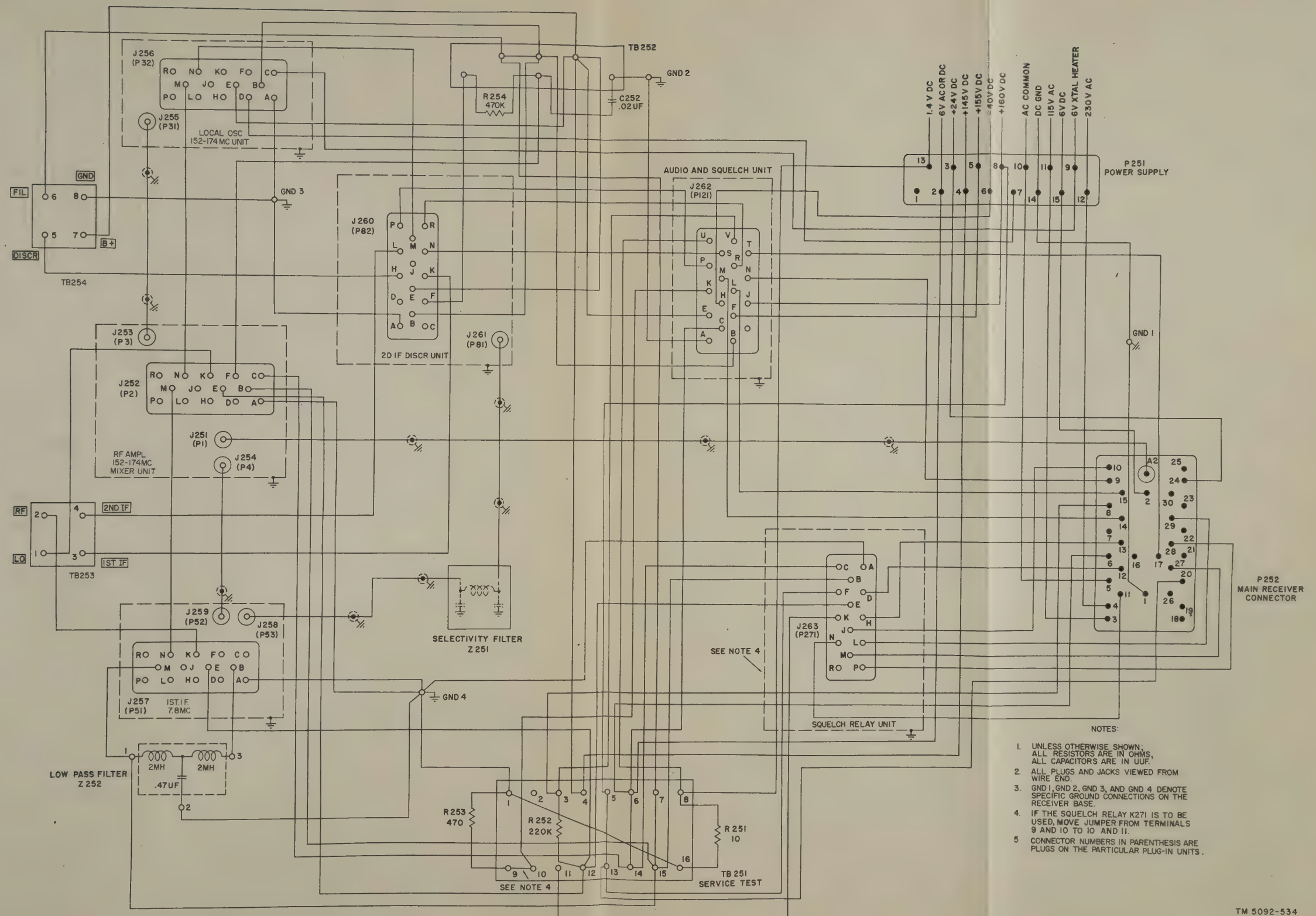
c. Plug P251. This plug provides a connection from the power supply to the receiver. It mates with each of the four power supplies that can be used with this receiver. A small handle on this plug aids connection and disconnection.

d. Filters Z251 and Z252. The i-f selectivity filter Z251 is connected between the second mixer (V52) and the first 455-kc i-f amplifier (V81). Filament voltage is applied to the 1ST IF 7.8-MC plug-in unit through filament filter Z252. Both filters are permanently wired into the receiver base. Selectivity filter Z251 is referred to in paragraph 50. Filament filter Z252 prevents stray r-f voltage from entering the filaments of V51, V52, and V53.

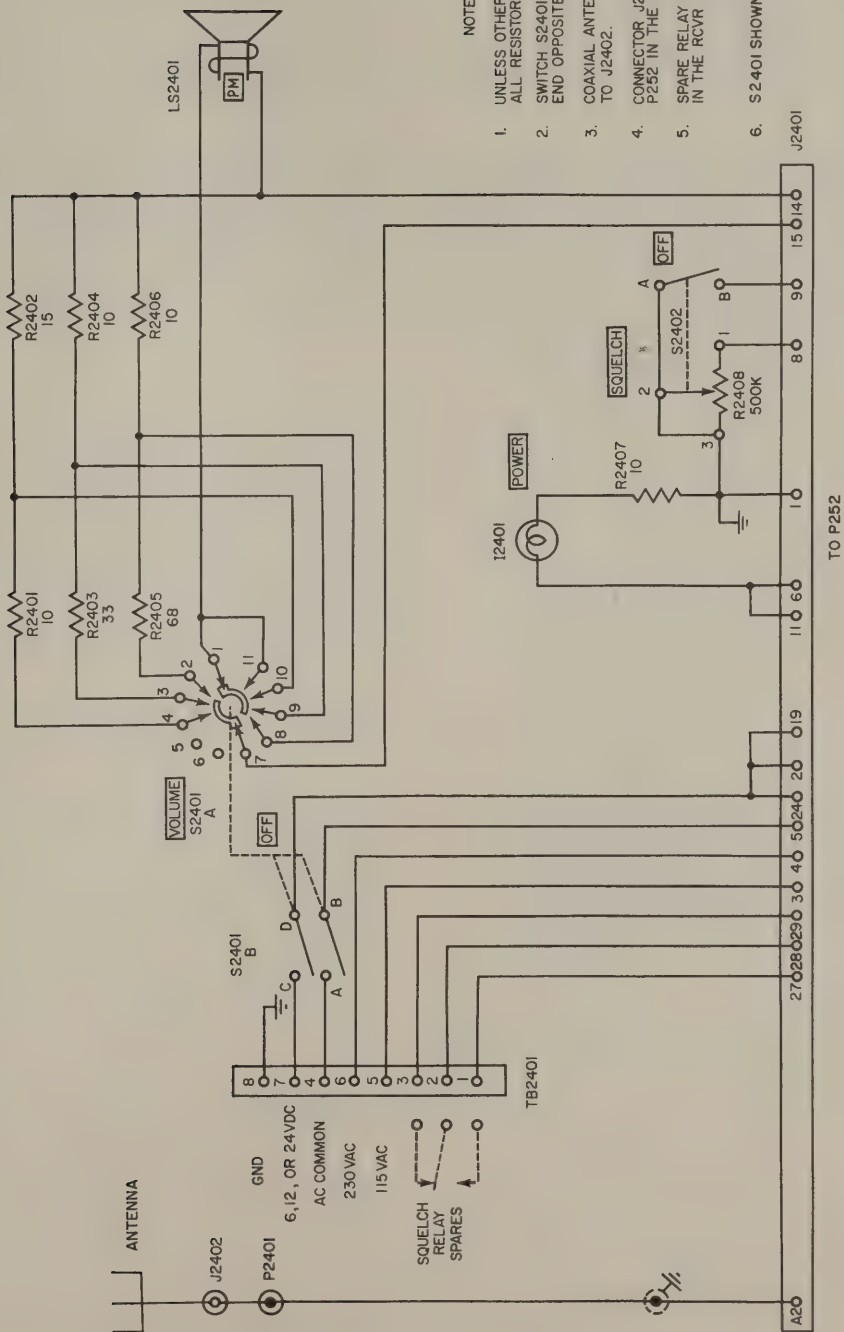
e. Terminal Boards TB251 and TB252. These terminal boards mount four resistors and one capacitor. A jumper change involving RELAY plug-in unit adaptation is made on TB251 (refer to par. 62). Resistor R254 and capacitor C252 (on TB252) are part of the agc decoupling network. Resistor R251 (on TB251) shunts and limits the 1.4-volt filament voltage. Resistor R252 (on TB251) is in series with the SQUELCH control (in the control unit),



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NOTES:

1. UNLESS OTHERWISE SHOWN;
ALL RESISTORS ARE IN OHMS.
2. SWITCH S2401 VIEWED FROM
END OPPOSITE KNOB.
3. COAXIAL ANTENNA CONNECTS
TO J2402.
4. CONNECTOR J2401 CONNECTS WITH
P252 IN THE RCVR BASE.
5. SPARE RELAY CONTACTS LOCATED
IN THE RCVR RELAY PLUG-IN UNIT.
6. S2401 SHOWN IN OFF POSITION.

TO P252

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Figure 37. Electrical Equipment Cabinet CY-1150/U, control circuit.

and resistor R253 (on TB251) is the cathode bias resistor for audio power amplifier V122.

63. Electrical Equipment Cabinet CY-1150/U (fig. 37)

a. This case is a compact unit which contains a typical control circuit and a loudspeaker for operation of Radio Receiver R-394/U. The complete assembly is Radio Set AN/FRR-36. This particular case (figs. 3 and 14) houses the receiver and power supply.

b. A blast-proof loudspeaker, LS2401, located at the front of the case, is used for converting the audio output voltage into audible sounds. VOLUME control S2401A is a wafer switch wired with resistors R2401 through R2406 and operates as a 4-position attenuator control. Maximum volume is obtained with this control fully clockwise. In the extreme counterclockwise position switch

S2401B (ganged to S2401A) breaks the power circuit of the radio set. POWER indicator lamp I2401 lights when the power is turned on. Resistor R2407 limits current through this lamp to the desired value.

c. SQUELCH control R2408 and squelch disable switch S2402 connect to the AUDIO & SQUELCH plug-in unit through connector J2401 and P252 (main receiver connector). When S2402 is closed, the audio grid circuits are grounded through this switch and the squelch circuit is disabled.

d. Connector J2401 mates with the main receiver connector P252 in the receiver. Terminal board TB2401 is located at the rear of Electrical Equipment Cabinet CY-1150/U and is used as junction points for power and the squelch relay contacts. The antenna is connected to the radio set through coaxial connectors J2402, P2401 and A2 on J2401.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When an external voltage is applied to the receiver, there is a possibility of electrical shock if contact is made with certain terminals or wires in the set. When used with Power Supply PP-846/U, the main receiver connector P252 and the power supply connector P251 have as much as 230-volts a-c on their terminals. The d-c power supplies have voltages as high as 150-volts d-c.

64. Trouble-shooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the plug-in unit or receiver base, whichever contains the defect. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults such as burned out resistors and shorted transformers often can be located by sight, smell, and hearing. The majority of the faults, however, must be localized by checking voltage and resistance.

a. System Sectionalization. System sectionalization is described in the instruction books of the radio systems in which Radio Receiver R-394/U is used.

b. Component Sectionalization and Localization. The tests listed below aid in isolating the source of trouble. To be effective, the steps in the procedure should be followed in the order given. Remember that servicing procedure should cause no further damage to the receiver. Trouble should be localized to a particular plug-in unit. Then the trouble should be isolated within the plug-in unit by appropriate voltage and resistance checks. The service procedure is summarized as follows:

- (1) *Visual inspection.* The purpose of visual inspection is to locate any visible trouble. Through this inspection the technician frequently will discover the trouble, or clues to the trouble. This inspection is valuable in avoiding additional damage to the receiver and in eliminating future failures.
- (2) *Input resistance measurement.* These measurements (pars. 69, 70, and 71) prevent further damage to the receiver from possible short

circuits. Since this test gives an indication of the condition of bypass capacitors its function is more than preventive.

- (3) *Operational test.* The operational test (par. 72) is important because it frequently indicates the general location of trouble. In many instances the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.
- (4) *Trouble-shooting chart.* The trouble symptoms listed in this chart (par. 74) will aid in localizing trouble.
- (5) *Signal substitution.* The principal advantage of the signal substitution method (par. 76) is that it usually enables the repairman to localize a trouble accurately and quickly to a given stage when the general location of the trouble is not immediately evident from the above tests.
- (6) *Intermittents.* In all these tests the possibility of intermittents should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the set. It is possible that the trouble is not in the receiver itself but in the installation, or the trouble may be due to external conditions. In this event, test the installation, if possible.

65. Trouble-shooting Data

Take advantage of the material supplied in this instruction book. It will help in the rapid location of faults. Consult the following figures:

Fig. No.	Title
8 thru 12	Radio Receiver R-394/U, tube locations.
37	Control circuit schematic diagram of Electrical Equipment Cabinet CY-1150/U.

Fig. No.	Title
43	Radio Receiver R-394/U, B+ voltage distribution diagram.
46	Radio Receiver R-394/U, RF AMPL 152-174 MC plug-in unit, tube socket voltage and resistance measurements.
47	Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, tube socket voltage and resistance measurements.
48	Radio Receiver R-394/U, LOCAL OSC 152-174 MC, terminal board voltage and resistance measurements.
49	Radio Receiver R-394/U, 1ST IF 7.8 MC plug-in unit, tube socket voltage and resistance measurements.
50	Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, tube socket voltage and resistance measurements.
51	Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, terminal board voltage and resistance measurements.
52	Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, tube socket voltage and resistance measurements.
53	Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, terminal board voltage and resistance measurements.
54	Radio Receiver R-394/U, RELAY plug-in unit, voltage and resistance measurements.
36	Radio Receiver R-394/U, base schematic diagram.
55	Radio Receiver R-394/U, base voltage and resistance measurement.
56	Radio Receiver R-394/U base, bottom view.
57	Radio Receiver R-394/U RF AMPL 152-174 MC plug-in unit, top view.
58	Radio Receiver R-394/U RF AMPL 152-174 MC plug-in unit, bottom view.
59	Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, top view.
60	Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, bottom view.
61	Radio Receiver R-394/U, 1ST IF 7.8 MC plug-in unit, top view.
62	Radio Receiver R-394/U, 1ST IF 7.8 MC plug-in unit, bottom view.
63	Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, top view.
64	Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, bottom view.
65	Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, top view.
66	Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, bottom view.
67	Radio Receiver R-394/U, RELAY plug-in unit, top view.

Fig. No.	Title
68	Radio Receiver R-394/U, RELAY plug-in unit, bottom view.
44	Radio Receiver R-394/U, filament circuits schematic diagram.
76	Radio Receiver R-394/U, schematic diagram.

66. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting Radio Receiver R-394/U is listed below. The technical manuals associated with the test equipment are also listed.

Test equipment	Publication
Signal Generators: Signal Generator SG-3, or Boonton Radio Corporation Model 202B, or equal. R.F. Signal Generator Set AN/URM-25 (if available), or Signal Generator TS-588A/U. Electronic Multimeters: Electronic Multimeter ME-6A/U, or ME-6B/U, or equal. Electronic Multimeter TS-505/U, or equal. Output Meter TS-585A/U or TS-585B/U. Frequency Standard TS-174B/U. Audio Oscillator TS-382A/U. Sound Analyzer TS-615/U. Tube Tester I-177 and sub-miniature tube adapter.	TM 11-1258 (when published). NAVSHIPS 91283 (URM-25). NAVSHIPS 91379 (URM-25A). NAVSHIPS 91472 (URM-25B). TM 11-5018. NAVSHIPS 91269 (ME-6A/U). NAVSHIPS 91493 (ME-6B/U). TM 11-5511. TM 11-5017. TM 11-5044. TM 11-2684A. TM 11-5032. TM 11-2627.

67. General Precautions

Observe the following precautions when servicing the receiver:

a. Exercise due caution when the power supply cover plate or the receiver base bottom cover is removed; voltages in excess of 230 volts may be present.

b. When removing the power supply, carefully remove the power supply plug P251 so that no damage to the plug contacts or wiring occurs.

c. Removal of the subminiature tubes should be accomplished with extreme care because the pins are very tiny and fragile. Do not tip or twist these tubes, but lift them straight upward away from the tube socket. When replacing them, be sure the red dots on the chassis and tube line up so that the proper connections are maintained.

d. Do not strip or damage the screws or Airloc fasteners used in the receiver. Always replace the required lockwashers when a part is removed and replaced.

e. Careless replacement of parts can be a source of additional faults. Take the following precautions when replacing a part in the receiver:

- (1) Before a part is unsoldered and removed, note the position of the leads. If the part has numerous leads or terminals, tag each wire or make a pencil diagram of the parts and its connections, so that the replacement part will not be wired incorrectly.
- (2) Be careful not to damage other parts or wires when it is necessary to remove a part.
- (3) Do not allow drops of solder to fall into the receiver, since they may cause short circuits.
- (4) A carelessly soldered connection may create a new defect. It is important to make well soldered joints, since a poorly soldered joint is one of the most difficult faults to detect. Since most of the parts are very small, and their leads short, solder connections as rapidly as possible in order to prevent over-heating of the parts, however, be sure the solder joint is a good one.
- (5) When a part is replaced in the r-f or i-f circuits, it must be positioned exactly as the original one was. A part which has the same electrical value but a different physical size or location may cause trouble in h-f or v-h-f circuits. Give particular attention to proper grounding when replacing a part. Use the same ground point as the original wiring. Failure to observe these directions may result in decreased gain or possibly in oscillation of the circuit due to regeneration.
- (6) Do not disturb the setting of the audio gain control, R127, unless this part is being replaced. If this is the case, adjust R127 as prescribed in paragraph 93. If necessary to adjust or test R127 when making a-f tests, mark its setting and reestablish

this setting at the conclusion of the test, or adjust it as prescribed.

- (7) When removing or replacing any "pluck-out" items such as tubes, crystal oven, crystals, plugs, or plug-in units, perform this function carefully, and be sure they are aligned properly when being replaced. This receiver and its parts are small, and in many instances more fragile than parts used in ordinary radio equipment.

68. Test Installation of Radio Receiver R-394/U

For testing purposes it is recommended that Radio Receiver R-394/U be connected by a patch cord (Electrical Special Purpose Cable Assembly CX-2371/U) to Electrical Equipment Cabinet CY-1150/U (figs. 38 and 39).

a. Installation of Power Supply.

- (1) If a 115-volt or 230-volt a-c source is available, use Power Supply PP-846/U. If a 115-volt source is used, connect wire jumpers between terminals 1 and 115-1 and between 2 and 115-2 or TB3001 in the power supply. If a 230-volt source is used, connect wire jumpers between terminals 1 and 230-1 and between 2 and 230-2 of TB3001 in the power supply. Install the power supply in the power supply compartment of the receiver (fig. 5) and connect P251 to the power supply connector.
- (2) If a 6-volt source of power is used, install Power Supply PP-869/U in the receiver and connect P251 to the power supply connector.
- (3) If a 12-volt source of power is used, install Power Supply PP-868/U in the receiver and connect P251 to the power supply connector.
- (4) If a 24-volt source of power is used, install Power Supply PP-867/U in the receiver and connect P251 to the power supply connector.

b. Connections to Electrical Equipment Cabinet CY-1150/U. Connect the patch cord between P252 of the receiver and J2401 of the cabinet (fig. 39).

- (1) When Power Supply PP-846/U is used with a 115-volt power source, connect the input power cord to terminals 4 and 5 of TB2401. When a 230-volt source is used, connect the input power cord to terminals 4 and 6 of TB2401.
- (2) When Power Supply PP-867/U, PP-868/U, or PP-869/U is used, connect the input power cord to terminals 7 and 8 of TB2401.

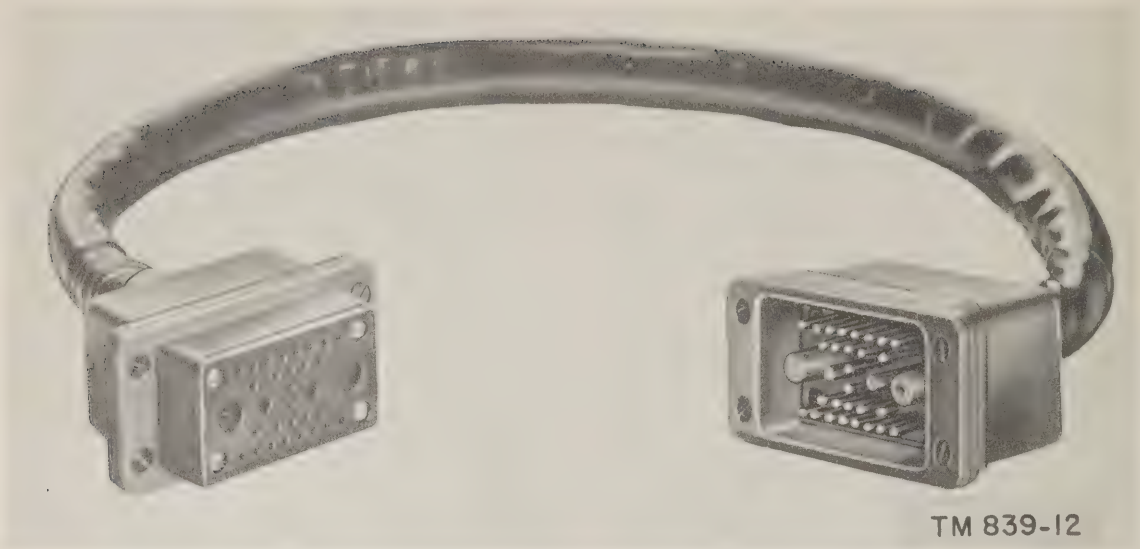


Figure 38. Electrical Special Purpose Cable Assembly CX-2371/U (patch cord).

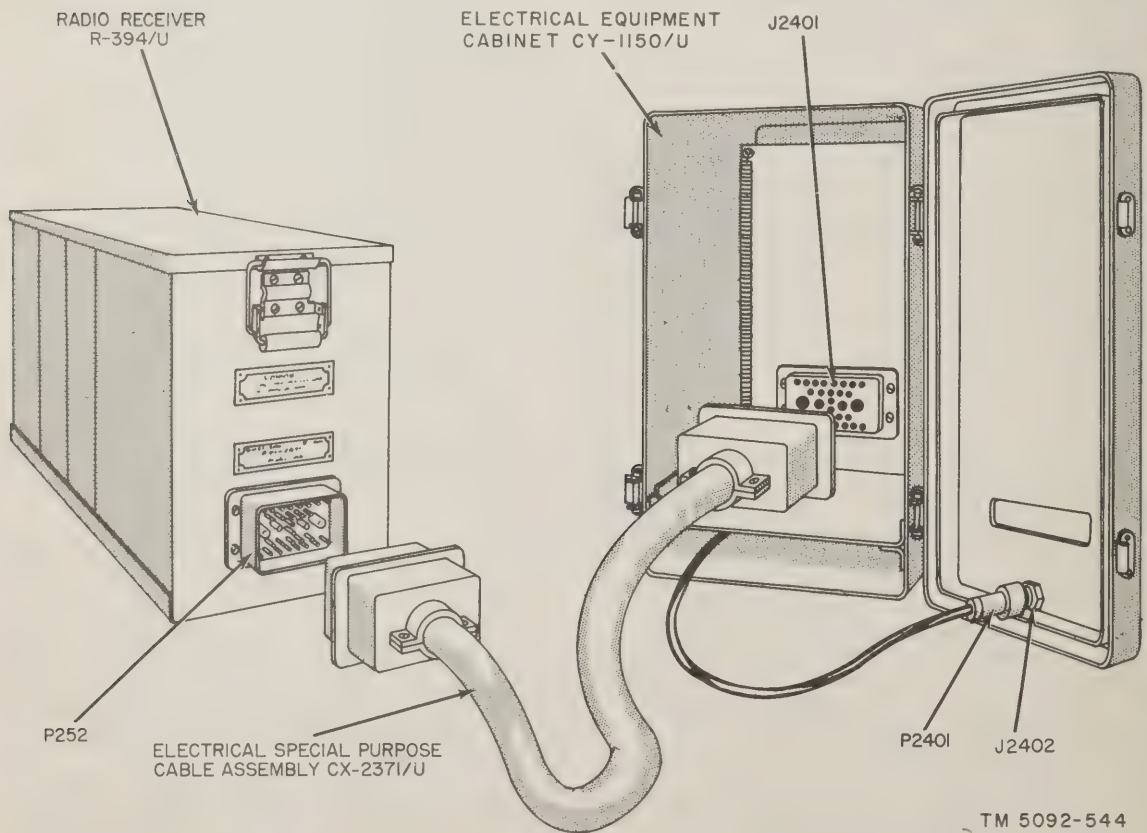


Figure 39. Radio Receiver R-394/U, patch cord connection to Electrical Equipment Cabinet CY-1150/U.

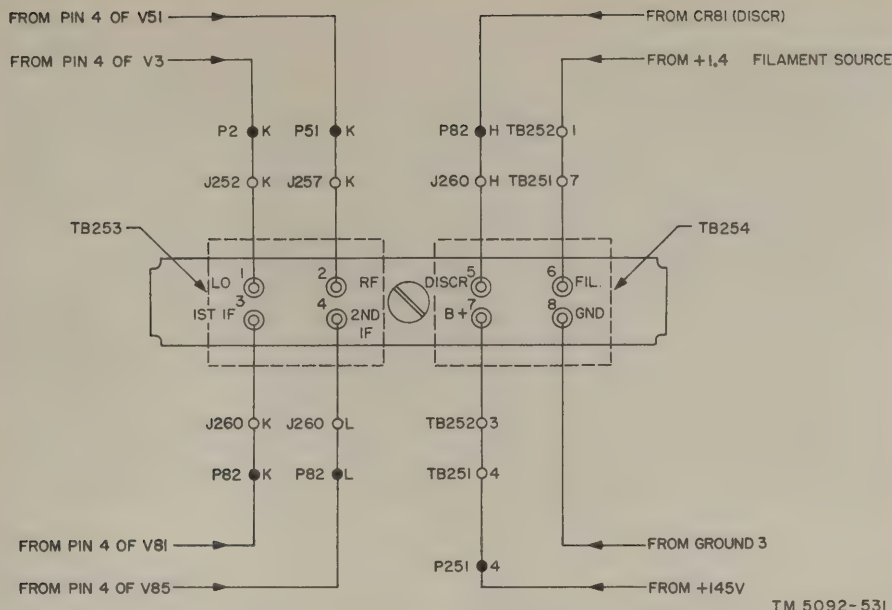


Figure 40. Radio Receiver R-394/U, front panel test points.

- (3) Connect the other end of the power cord to the power source (230-volt a-c, 115-volt a-c, or 6-, 12-, or 24-volt d-c).

69. Checking for B+ Shorts

a. A B+ short can disable the entire receiver, or it can result in erratic operation. Defective capacitors can at times be difficult to detect by an ohmmeter check. Sometimes they become leaky, which means that they allow direct current to pass through them. References to the B+ distribution schematic diagram (fig. 43) and to voltage and resistance illustrations (figs. 45 through 55) will aid in locating B+ shorts.

b. After determining that the trouble is not in the power supply, sectionalize the trouble to the receiver base or one of the plug-in units. A B+ short may not necessarily blow a power supply fuse, but may cause certain resistors to become overheated. If the B+ voltage, as measured at the front panel test point marked B+, is quite low, pull out each plug-in unit, one at a time, while watching the voltage reading at this test point. Removing one plug-in unit will unload the power supply because the filament circuit is opened and the B+ will rise slightly. If one of the plug-in units contains a B+ short which overloads the power supply appreciably, the power supply fuse may or may not blow, depending upon the excessiveness of the B+ current. Removing one plug-in unit at a time in some cases will indicate which plug-in unit contains the B+ short. Removal of the defective unit will cause the

B+ reading to increase to a value slightly higher than that produced by removal of non-defective units.

c. Since a B+ short often will cause resistors or capacitors to overheat, inspect the receiver base and each plug-in unit for evidence of charred or discolored resistors or capacitors. Ceramic type capacitors, as used in this receiver, often will burn a white spot on their body which can be easily detected. If charred resistors are located, check their bypass capacitors with an ohmmeter. It is advisable to locate B+ shorts by resistance checks if parts in the receiver are overheating. If a leaky capacitor is causing the trouble, and none of the parts seem to be overheating, plate voltage and screen voltage measurements with a voltmeter or VTVM (vacuum-tube voltmeter) can localize the trouble to the defective part. Leaky coupling capacitors can be located by checking for a positive voltage on the control grids of the tubes. If this is the case, test the tubes involved, as a positive grid voltage may cause excessive plate current and damage the tube.

d. Replace charred or discolored resistors even if they are close to their required value. A resistor that has been overheated often will crack, change in value appreciably, or open.

70. Checking Filament Circuits

a. Radio Receiver R-394/U uses two filament voltages, 6.3-volt a-c or d-c, and 1.4-volt d-c. Each plug-in unit (except the RELAY plug-in unit)

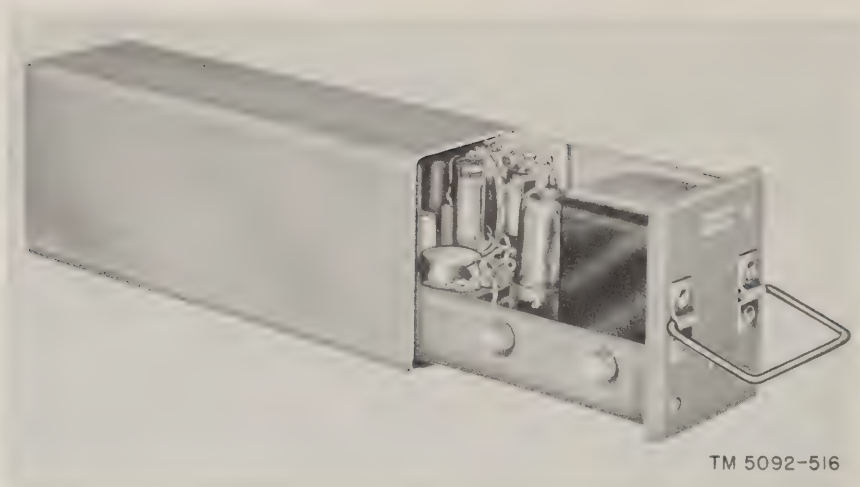


Figure 41. Plug-in unit with cover partially removed.

contains an interlock jumper which opens the 1.4-volt filament circuit when the plug-in unit is removed. The normal filament voltage depends upon all the tubes drawing their normal current. If it were not for this filament interlock feature the filament voltage on the remaining tubes would rise whenever one of the plug-in units was removed from the receiver base.

b. Reference to figure 44 shows the filament distribution through the receiver. Ground connections marked GND 1 through GND 4 are specific ground points in the receiver base, and are indicated as such for the purpose of location and identification. This schematic diagram will aid in locating defects in the filament circuits.

c. Most of the filaments are bypassed to ground with ceramic capacitors. Defects in the filament circuits may be caused by shorts through these capacitors.

71. Checking B+ and Filament Circuit Defects in Receiver Base

a. The receiver base consists mainly of cables and connectors with the exception of a few resistors and capacitors. In the event that a defect in the B+ circuit or the filament circuit has been sectionalized to the receiver base, check the base as described below.

b. Remove the receiver from its case and also remove the power supply and all the plug-in units. The receiver base schematic diagram (fig. 36) and the over-all receiver schematic (fig. 76) will be of assistance in trouble shooting. If the trouble is known to be in the filament circuits, use the fila-

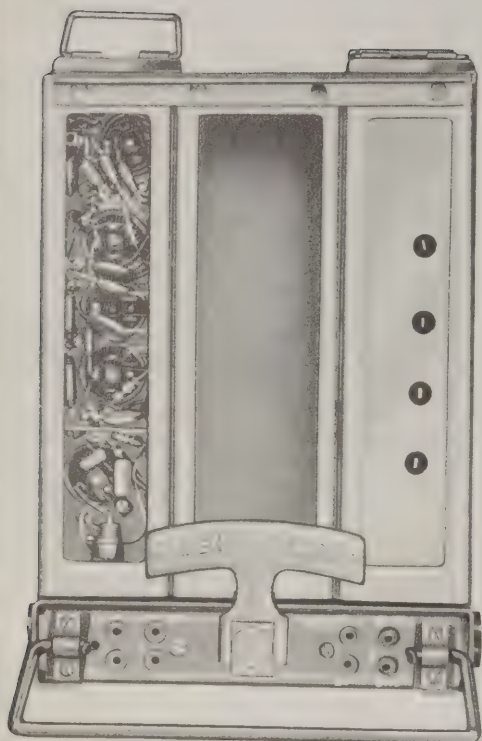


Figure 42. Radio Receiver R-394/U, front view showing accessibility of plug-in units when installed.

10 MAY 1954

**ADDENDA NO. 9 TO
INSTRUCTION BOOK
FOR
RADIO RECEIVER R-394/U**

The following information, published on Order No. 11661-Phila-52, is to be added to the instruction book in addition to that provided by Addenda No. 3, 15 June 1953, and Addenda No. 4, 3 August 1953. This addenda supersedes Addenda No. 5, 23 October 1953, Addenda No. 6, 27 October 1953, Addenda No. 7, 31 December 1953, and Addenda No. 8, 29 March 1954.

Enter suitable notations beside each affected paragraph and figure in the instruction book and in Addenda No. 3 to indicate the presence of this supplementary information.

MAKE THE FOLLOWING CHANGES TO ADDENDA NO. 3:

Page 13. Fig. 64.1. Change the figure caption to read: *Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, bottom view.*

Add the following note to the figure.

NOTE 1. FILTER FL81 IS USED ONLY IN 2ND IF DISCR PLUG-IN UNITS ON ORDER NO. 11661-P-52 BEARING SERIAL NUMBERS 1 THROUGH 5550. IN UNITS BEARING SERIAL NUMBERS 5551 AND HIGHER, FL81 IS REPLACED BY CAPACITORS C111 AND C112 AND RESISTOR R115.

Page 19. Fig. 76.1. Make the following changes in figure 76.1:

Change reference symbols L192 and L193 to read: L92 and L93, respectively.

Add the following note to the figure.

7. FILTER FL81 IS USED ONLY IN 2ND IF DISCR PLUG-IN UNITS ON ORDER NO. 11661-P-52 BEARING SERIAL NUMBERS 1 THROUGH 5550. IN UNITS BEARING SERIAL NUMBERS 5551 AND HIGHER, FL81 IS REPLACED BY INDIVIDUAL CAPACITORS AND A RESISTOR, READING FROM LEFT TO RIGHT, C111 (150 UUF), R115 (47K), AND C112 (100 UUF).

MAKE THE FOLLOWING CHANGES TO THE INSTRUCTION BOOK:

Page 1. Par. 1. Change the last sentence to read:

There also is an appendix that includes a list of references.

Page 1. Par. 4. Make the following changes in subparagraph a:

In line 3, change "four" to read: five.

In line 5, after "AN/FRC-27" add the following: Radio Set AN/TRC-34.

Page 2. Fig. 2. Make the following changes in figure 2:

Change Electrical Equipment Cabinet "CY-938/VRC" to read: CY-938/VRC or CY-938A/VRC.

Change Electrical Equipment Cabinet "CY-1221 G" to read: CY-1221 G or CY-1221-A/G, in the two places where it appears.

Change Radio Set "AN/FRC-27" to read: AN/FRC-27 or Radio Set AN/TRC-34.

Page 3. Par. 4. Make the following changes in subparagraph *c*:

In line 7, change "Cabinet CY-938/VRC" to read: Cabinet CY-938/VRC or CY-938A/VRC.

In the last line, change "30 watts" to read: 25 watts on frequencies between 152 and 162 mc and 20 to 25 watts on frequencies between 162 and 174 mc.

Page 3. Par. 4. In subparagraph *d*, line 10, change "(50 watts)" to read: (45 watts).

Page 5. Par. 4. Add the following after subparagraph *e*:

f. Radio Set AN/TRC-34. Radio Set AN/TRC-34 is similar to Radio Set AN/FRC-27. The only difference is that Radio Set AN/TRC-34 does not include a base stand.

Page 5. Par. 5. Make the following changes:
In item 4, change " ± 15 " to read: ± 18 .

In item 9, change "2,500" to read: 3,500.

Add the following after item 3:

Type of 1st h-f oscillator crystal. .CR-32/U

Type of 2nd h-f oscillator crystal. .CR-18/U

Page 7. Par. 7. In subparagraph *c* (7), lines 3 and 4, change "7.8-mc i-f amplifier (V51)" to read: 1ST IF 7.8 MC plug-in unit.

In lines 4 and 5, change "455-kc i-f amplifier

to read: 2ND IF DISCR plug-in unit.

Page 9. Par. 13. In subparagraph *e*, line 6, change "R-394" to read: R-394/U.

Page 17. Par. 23. In the paragraph heading change "Artic" to read: Arctic.

Page 25. Par. 40a. Make the following changes in the second column:

In lines 4 and 5 from the top of the page, change "V31, V32, and V33" to read: V31, V32, V33, and V34.

In line 13, change "second mixer V52" to read: 7.8-mc i-f amplifier V51.

Page 31. Par. 44. Make the following changes in subparagraph *a*:

In line 10 from the bottom, change "C32A" to read: C47A.

In line 7 from the bottom, change "C32B" to read: C47B.

In line 3 from the bottom, change "C31" to read: C46.

Page 31. Par. 45. Make the following changes in line 3:

Add the following after (V3): The grid circuit of V51 is tuned by Z51.

In the next sentence, change "grid circuit" to read: plate circuit.

Page 32. Fig. 20. Make the following changes in figure 20:

Change the value of L31 from 6.6-10.3UH to 6.6-16UH.

Change "C32A" to read: C47A.

Change "C32B" to read: C47B.

Change the value of L42 from 1.6UH to 6.5UH.

Page 39. Fig. 26. Change the value of C252 from .02UF to .022UF.

Page 41. Fig. 28. Make the following changes in figure 28:

Add the following note to the figure.

3. FILTER FL81 IS USED ONLY IN 2ND IF DISCR PLUG-IN UNITS ON ORDER NO. 11661-P-52 BEARING SERIAL NUMBERS 1 THROUGH 5550. IN UNITS BEARING SERIAL NUMBERS 5551 AND HIGHER, FL81 IS REPLACED BY INDIVIDUAL CAPACITORS AND A RESISTOR, READING FROM LEFT TO RIGHT, C111 (150 UUF), R115 (47K) AND C112 (100 UUF).

Insert reference symbol "T81" between terminals 1 and 3 of the discriminator transformer.

Page 43. Par. 56. Make the following changes in subparagraph *d*:

In line 7, change "R47" to read: R114.

In subparagraph *d*(4), line 5, add the following after FL81: FL81 is used only in 2ND IF DISCR plug-in units on Order No. 11661-P-52 bearing serial numbers 1 through 5550. In units with serial numbers 5551 and higher, FL81 is replaced by C111, R115, and C112.

Page 43. Par. 57. In line 5 from the bottom of the page, change "L212" to read: L112.

Page 46. Par. 59. In subparagraph *h*, line 7, change "V124" to read: V123.

Page 61. Fig. 43. On the lead marked TO TEST POINT 2ND IF, change R110 to read: R111.

Page 76. Par. 77. Add the following "Note" after subparagraph *f*:

Note. Filter FL81 is used only in 2ND IF DISCR plug-in units on Order No. 11661-P-52 bearing serial numbers 1 through 5550. In units with serial numbers 5551 and higher, FL81 is replaced by two individual capacitors and one resistor.

Page 79. Par. 82. In the stage gain chart of sub-

paragraph *c*, add the following after FL81: (Junction of R112 and C111 in 2ND IF DISCR plug-in units bearing serial numbers higher than 5550).

Page 81. Fig. 56. Reverse the locations of the lock-in rod handle (at the extreme right side of the figure) and the locking stud (at the extreme left side of the figure).

Page 90. Par. 91. Delete subparagraph *a* and substitute the following:

a. RF AMPL 152-174 MC Plug-in Unit Aline-ment Procedure.

- (1) *Presetting tuning cores.* Before aligning the RF AMPL 152-174 MC plug-in unit, it will be necessary to preset the tuning core slugs in order to allow a signal to pass through the detuned stages. This is accomplished by adjusting the tuning cores to their approximate correct positions. The chart below lists various receiver frequencies and the corresponding number of turns that the tuning cores must be adjusted for each frequency. Columns 2 and 3 list the number of turns that the core slugs must be turned *in* from the extreme counterclockwise positions. To use these two columns the five tuning cores (Z1, Z2, Z3, Z4, and Z5) first must be turned to their extreme counterclockwise positions. In this position the top of the screws will extend approximately 13/16 of an inch above the chassis. If the equipment is received directly from the factory it is not necessary to turn all adjustments to the extreme counterclockwise position before pre-setting. The receivers are tuned for 165.075 mc at the factory and column 4 lists the direction and number of turns that the tuning cores must be changed from the factory set position. A spot of paint or some other type of mark on the alinement tool will make it easier to count the number of turns. Tuning slug Z6 is preset to 7.8 mc at the factory and must not be disturbed until all other coils have been alined.

1	2	3	4
Receiver frequency (mc)	No. of clockwise turns of turning core		No. of turns of tuning cores from factory set position (Z1, Z2, Z3, Z4, and Z5)
	Z1, Z2, Z4	Z3, Z5	
152	7	9	10 out (counterclockwise)
153	8	10	9 out (counterclockwise)
154	9	11	8 out (counterclockwise)
155	10	12	7 out (counterclockwise)
156	10 $\frac{3}{4}$	12 $\frac{3}{4}$	6 $\frac{1}{4}$ out (counterclockwise)
157	11 $\frac{1}{2}$	13 $\frac{1}{2}$	5 $\frac{1}{2}$ out (counterclockwise)
158	12 $\frac{1}{4}$	14 $\frac{1}{4}$	4 $\frac{3}{4}$ out (counterclockwise)
159	13	15	4 out (counterclockwise)
160	13 $\frac{3}{4}$	15 $\frac{3}{4}$	3 $\frac{1}{4}$ out (counterclockwise)
161	14 $\frac{1}{2}$	16 $\frac{1}{2}$	2 $\frac{1}{2}$ out (counterclockwise)
162	15 $\frac{1}{4}$	17 $\frac{1}{4}$	1 $\frac{3}{4}$ out (counterclockwise)
163	15 $\frac{3}{4}$	17 $\frac{3}{4}$	1 $\frac{1}{4}$ out (counterclockwise)
164	16 $\frac{1}{2}$	18 $\frac{1}{2}$	$\frac{1}{2}$ out (counterclockwise)
165	17	19	0
166	17 $\frac{3}{4}$	19 $\frac{3}{4}$	$\frac{3}{4}$ in (clockwise)
167	18 $\frac{1}{2}$	20 $\frac{1}{2}$	1 $\frac{1}{2}$ in (clockwise)
168	19 $\frac{1}{4}$	21 $\frac{1}{4}$	2 $\frac{1}{4}$ in (clockwise)
169	20 $\frac{1}{4}$	22 $\frac{1}{4}$	3 $\frac{1}{4}$ in (clockwise)
170	21	23	4 in (clockwise)
171	21 $\frac{3}{4}$	23 $\frac{3}{4}$	4 $\frac{3}{4}$ in (clockwise)
172	22 $\frac{1}{2}$	24 $\frac{1}{2}$	5 $\frac{1}{2}$ in (clockwise)
173	23 $\frac{1}{4}$	25 $\frac{1}{4}$	6 $\frac{1}{4}$ in (clockwise)
174	24	26	7 in (clockwise)

(2) *Final adjustment.* After the RF AMPL 152-174 MC plug-in unit has been roughly preset it must be accurately aligned. To perform this accurate alinement, use the following procedure:

(a) Connect a signal generator between plug P1 and chassis ground. Set the signal generator output to 20 microvolts. This should be sufficient to allow a signal to pass through the preset stages.

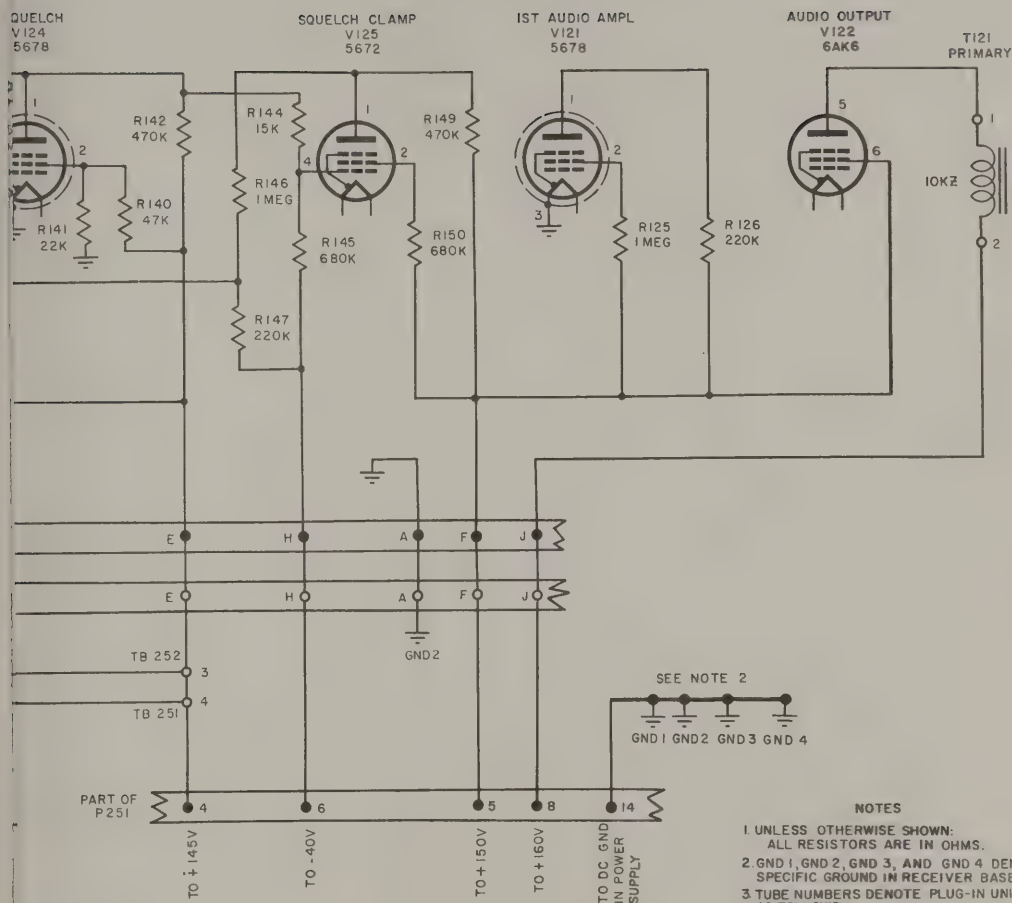
(b) Connect a vtvm between the 2ND

IF and GND test points located on the front panel of the receiver.

(c) Adjust Z1, Z2, Z3, Z4, and Z5 for a maximum negative output as indicated on the meter. Repeat this procedure at least 3 times. If the vtvm reads off-scale, reduce the signal generator output.

Page 99. Par. 108. In line 2, change "108" to read: 109.

Pages 105 through 124. Delete appendix II, Identification Table of Parts.



NOTES

1. UNLESS OTHERWISE SHOWN:
ALL RESISTORS ARE IN OHMS.
2. GND 1, GND 2, GND 3, AND GND 4 DENOTES
SPECIFIC GROUND IN RECEIVER BASE.
3. TUBE NUMBERS DENOTE PLUG-IN UNITS
AS FOLLOWS:
V1, V2, AND V3, RF AMPL 152-174 MC.
V31, V32, V33, AND V34, LOCAL OSC 152-174 MC.
V51, V52, AND V53, 1ST IF 7.8 MC.
V81 THROUGH V87, 2D 1F AND DISCR.
V121 THROUGH V125, AUDIO AND SQUELCH.

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Figure 43. Radio Receiver R-394/U, B+ distribution diagram.

1	2	3	4
Receiver frequency (mc)	No. of clockwise turns of turning core		No. of turns of tuning cores from factory set position (Z1, Z2, Z3, Z4, and Z5)
	Z1, Z2, Z4	Z3, Z5	
152	7	9	10 out (counterclockwise)
153	8	10	9 out (counterclockwise)
154	9	11	8 out (counterclockwise)
155	10	12	7 out (counterclockwise)
156	10 $\frac{3}{4}$	12 $\frac{3}{4}$	6 $\frac{1}{4}$ out (counterclockwise)
157	11 $\frac{1}{2}$	13 $\frac{1}{2}$	5 $\frac{1}{2}$ out (counterclockwise)
158	12 $\frac{1}{4}$	14 $\frac{1}{4}$	4 $\frac{3}{4}$ out (counterclockwise)
159	13	15	4 out (counterclockwise)
160	13 $\frac{3}{4}$	15 $\frac{3}{4}$	3 $\frac{1}{4}$ out (counterclockwise)
161	14 $\frac{1}{2}$	16 $\frac{1}{2}$	2 $\frac{1}{2}$ out (counterclockwise)
162	15 $\frac{1}{4}$	17 $\frac{1}{4}$	1 $\frac{3}{4}$ out (counterclockwise)
163	15 $\frac{3}{4}$	17 $\frac{3}{4}$	1 $\frac{1}{4}$ out (counterclockwise)
164	16 $\frac{1}{2}$	18 $\frac{1}{2}$	$\frac{1}{2}$ out (counterclockwise)
165	17	19	0
166	17 $\frac{3}{4}$	19 $\frac{3}{4}$	$\frac{3}{4}$ in (clockwise)
167	18 $\frac{1}{2}$	20 $\frac{1}{2}$	1 $\frac{1}{2}$ in (clockwise)
168	19 $\frac{1}{4}$	21 $\frac{1}{4}$	2 $\frac{1}{4}$ in (clockwise)
169	20 $\frac{1}{4}$	22 $\frac{1}{4}$	3 $\frac{1}{4}$ in (clockwise)
170	21	23	4 in (clockwise)
171	21 $\frac{3}{4}$	23 $\frac{3}{4}$	4 $\frac{3}{4}$ in (clockwise)
172	22 $\frac{1}{2}$	24 $\frac{1}{2}$	5 $\frac{1}{2}$ in (clockwise)
173	23 $\frac{1}{4}$	25 $\frac{1}{4}$	6 $\frac{1}{4}$ in (clockwise)
174	24	26	7 in (clockwise)

(2) *Final adjustment.* After the RF AMPL 152-174 MC plug-in unit has been roughly preset it must be accurately aligned. To perform this accurate alignment, use the following procedure:

(a) Connect a signal generator between plug P1 and chassis ground. Set the signal generator output to 20 microvolts. This should be sufficient to allow a signal to pass through the preset stages.

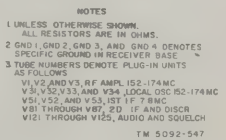
(b) Connect a vtvm between the 2ND

IF and GND test points located on the front panel of the receiver.

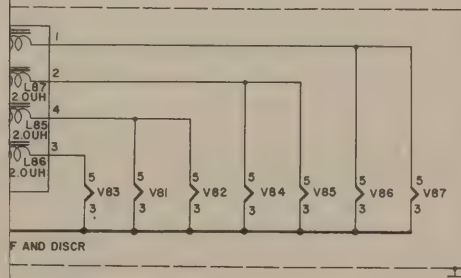
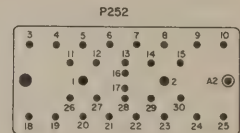
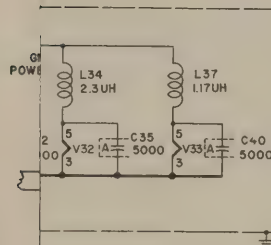
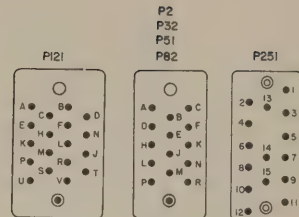
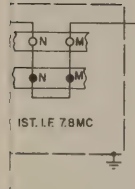
(c) Adjust Z1, Z2, Z3, Z4, and Z5 for a maximum negative output as indicated on the meter. Repeat this procedure at least 3 times. If the vtvm reads off-scale, reduce the signal generator output.

Page 99. Par. 108. In line 2, change "108" to read: 109.

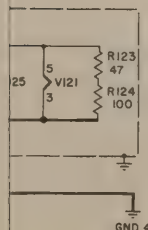
Pages 105 through 124. Delete appendix II, Identification Table of Parts.



51



- NOTES:
1. UNLESS OTHERWISE SHOWN:
ALL CAPACITORS ARE IN UUF.
ALL RESISTORS ARE IN OHMS.
 2. NUMBERED GROUNDS ARE SPECIFIC
CHASSIS GROUNDS IN RECEIVER BASE.



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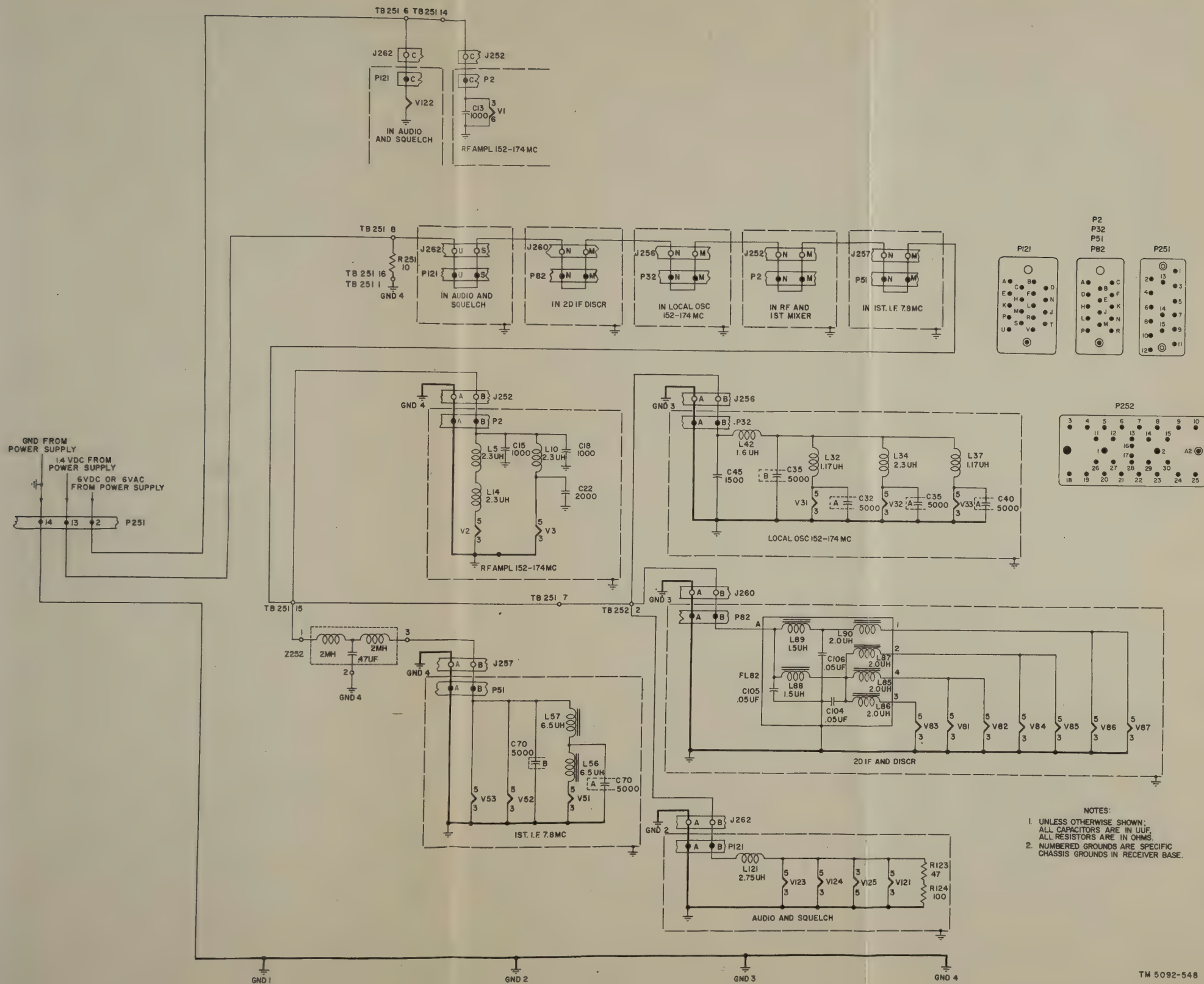
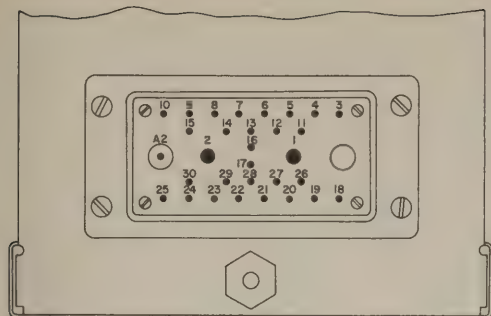


Figure 44. Radio Receiver R-394/U, filament distribution schematic diagram.



TERMINAL	RESISTANCE	TERMINAL	RESISTANCE	TERMINAL	RESISTANCE
1	0	11	∞	21	∞
2	∞	12	∞	22	∞
3	∞	13	∞	23	∞
4	∞	14	0	24	∞
5	∞	15	.6	25	∞
6	21	16	∞	26	∞
7	∞	17	1.5 MEG	27	∞
8	140K	18	∞	28	∞
9	900K	19	∞	29	∞
10	∞	20	∞	30	∞
				A2	100K

NOTES:

- I. RESISTANCE MEASUREMENTS MADE AT CONNECTOR P252 WITH POWER SUPPLY REMOVED FROM THE RECEIVER
2. ALL RESISTANCE MEASUREMENTS MADE WITH A VTVM BETWEEN GROUND AND TERMINALS SPECIFIED.

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Figure 45. Radio Receiver R-394/U, resistance measurements on main connector P252.

ment circuits schematic diagram (fig. 44). If the trouble lies in the B+ circuits use the B+ distribution diagram (fig. 43).

c. Resistance measurements between points in the receiver base will aid in detecting open circuits. Figure 55 shows voltages obtained in the receiver base when the receiver is operating. Resistance measurements are taken with the receiver disconnected from the radio set case.

72. Operational Test

After completing the check and repair of any defects in the B+ and filament circuits, operate the receiver as described in paragraphs 17 through 21.

If defects still exist, follow the procedures described in the remaining paragraphs of this section (pars. 73 through 82).

73. Sectionalizing Trouble to a Plug-in Unit

a. In most cases the failure of Radio Receiver R-394/U will be due to trouble in one of the plug-in units. The first step in trouble shooting the receiver consists of measuring the filament voltage and the B+ voltage at the test jacks (FIL and B+, respectively) on the front panel of the receiver. These tests indicate whether the proper power is being obtained by the receiver. The first r-f amplifier, V1, and the audio power amplifier, V122, are the only tubes using 6 volts as heater voltage. A test for this voltage can be made by removing the RF AMPL 152-174 MC plug-in unit and the AUDIO & SQUELCH plug-in unit and actually feeling these two tubes to determine whether they are warm, as they should be if the 6-volt heater voltage is present.

b. The next step consists of removing each plug-in unit and replacing it with a similar unit known to be in operating condition. In order for this test to be complete, the RF AMPL 152-174 MC plug-in unit and the LOCAL OSC 152-174 MC plug-in unit being used for the substitution test must be aligned previously to the same frequencies as the two similar units under test.

c. After the defective plug-in unit has been isolated it can be checked while installed in the receiver base. Use the trouble-shooting chart (par. 74).

74. Trouble-shooting Chart

The following chart is supplied as an aid in locating trouble in the receiver. It lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. The signal substitution test outlined in paragraph 76 can then be used to supplement this procedure and to determine the defective stage. After the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit should ordinarily be sufficient to isolate the defective parts. Normal voltage and resistance measurements are given in figures 45 through 55.

Symptom	Probable trouble	Correction
1. VOLUME control in control unit turned clockwise so power to receiver should be turned on. POWER pilot lamp in control unit fails to light.	1. Receiver main connector P252 not making good contact.	1. Remove receiver from case and inspect P252 and its mating connector. Replace receiver carefully and test for power at test points B+ and FIL.

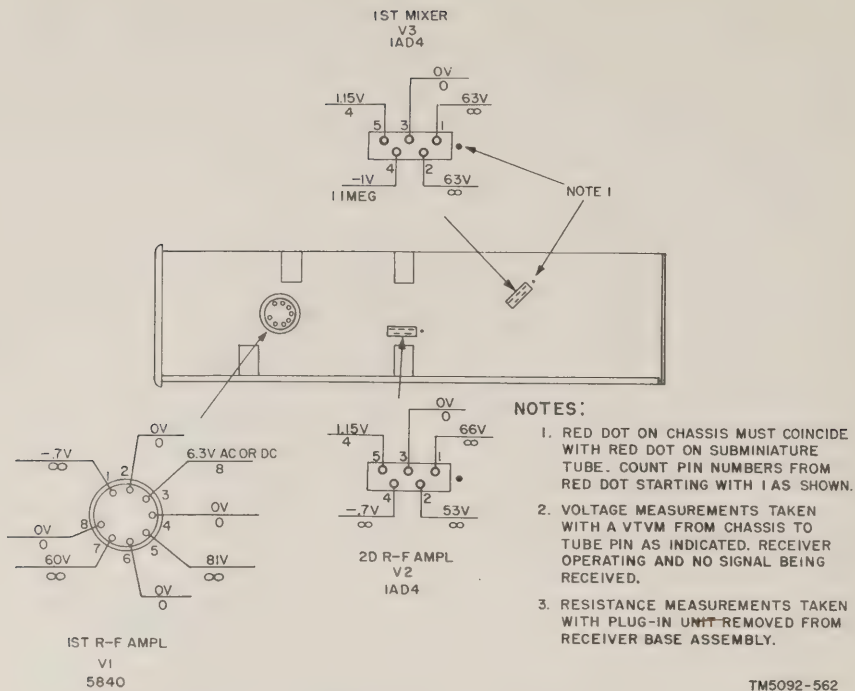


Figure 46. Radio Receiver R-394/U, RF AMPL 152-174 MC plug-in unit, tube socket voltage and resistance measurements.

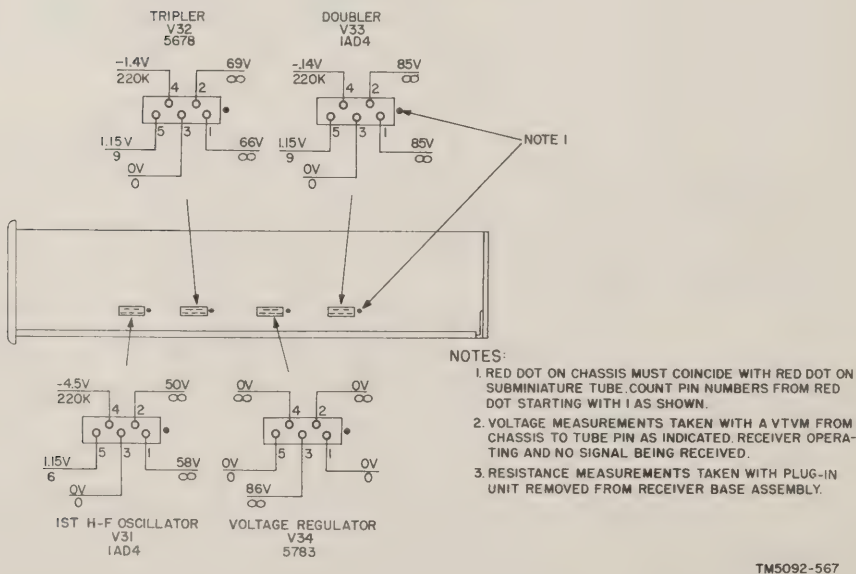
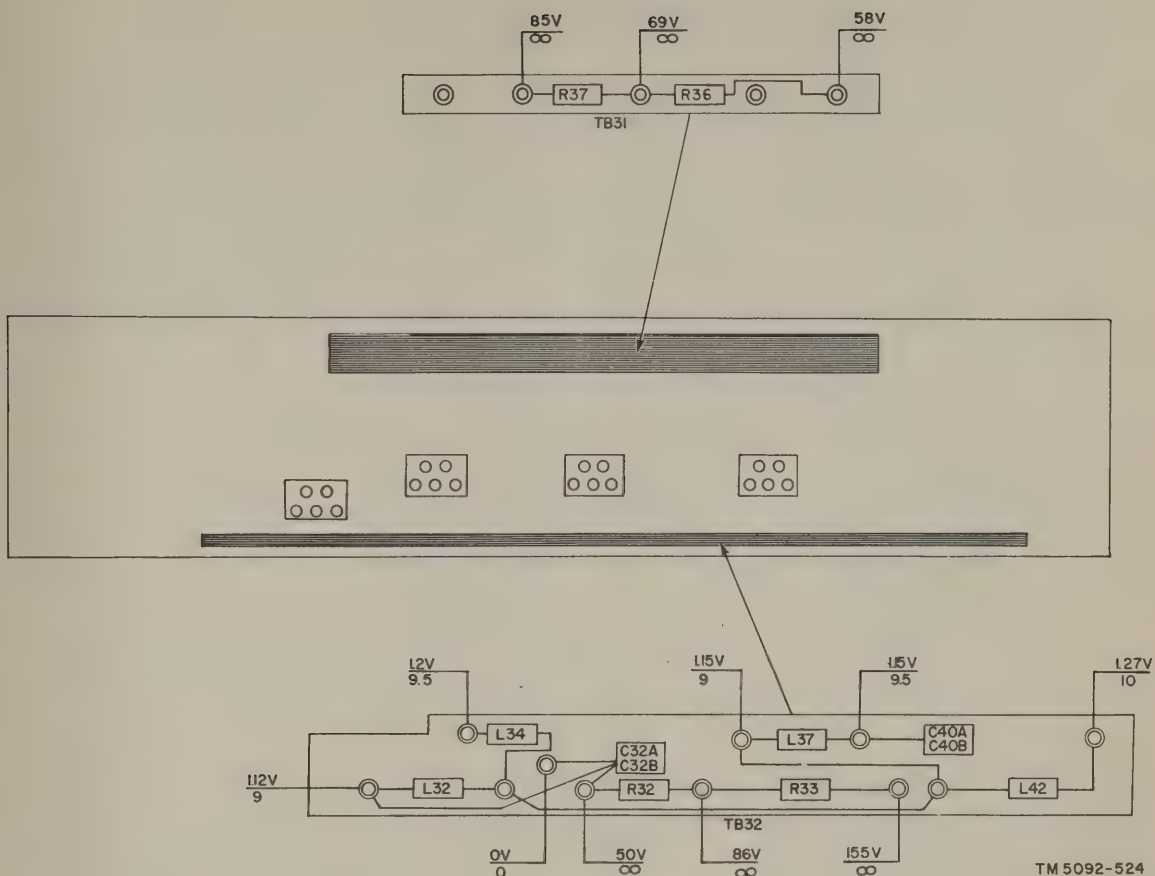
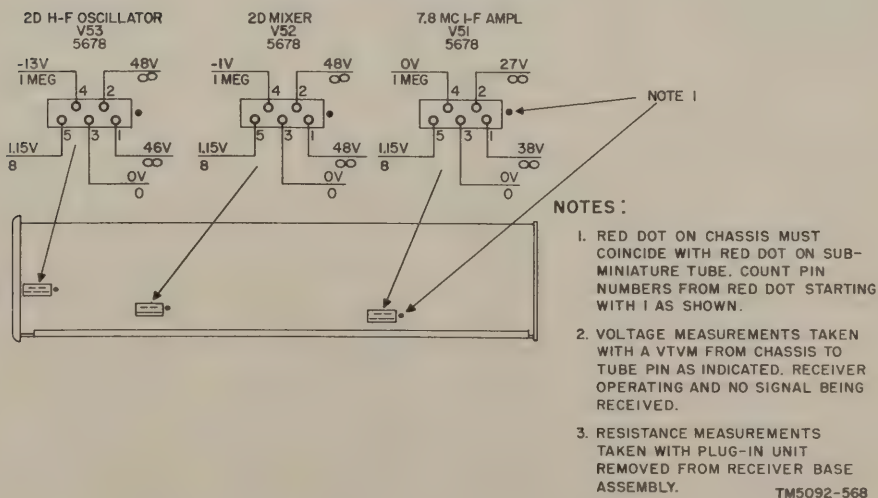


Figure 47. Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, tube socket voltage and resistance measurements.



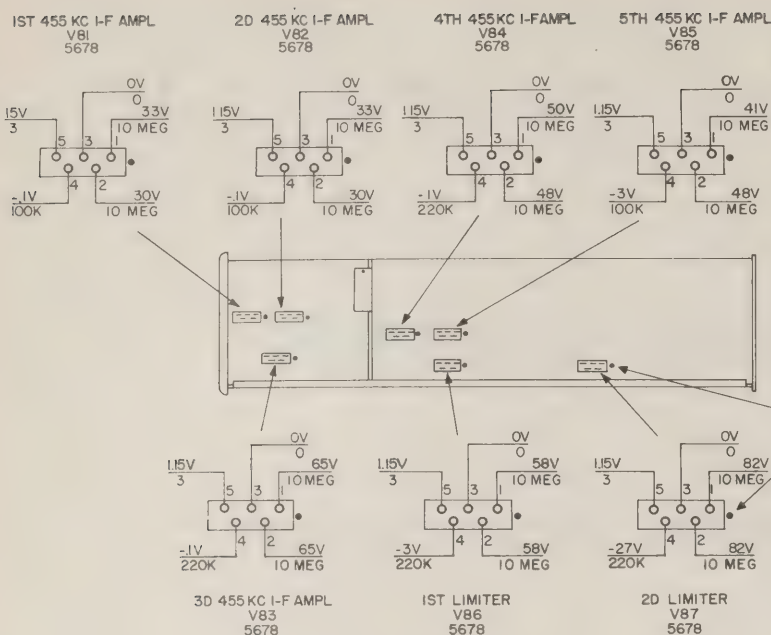
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Figure 48. Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, terminal board voltage and resistance measurements.



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Figure 49. Radio Receiver R-394/U, IST IF 7.8 MC plug-in unit, tube socket voltage and resistance measurements.



NOTES:

1. RED DOT ON CHASSIS MUST COINCIDE WITH RED DOT ON SUBMINIATURE TUBE. COUNT PIN NUMBERS FROM RED DOT STARTING WITH 1 AS SHOWN.
2. VOLTAGE MEASUREMENTS TAKEN WITH A VTVM FROM CHASSIS TO TUBE PIN AS INDICATED, RECEIVER OPERATING AND NO SIGNAL BEING RECEIVED.
3. RESISTANCE MEASUREMENTS TAKEN WITH PLUG-IN UNIT REMOVED FROM RECEIVER BASE ASSEMBLY.

NOTE 1

TM5092-569

Figure 50. Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, tube socket voltage and resistance measurements.

74. Trouble-shooting Chart (contd)

Symptoms	Probable trouble	Correction
2. No audio output even when SQUELCH control is turned fully CW so as to set the squelch disable switch in the OFF position.	2. (a) Defective tubes (V121 or V122) (b) T121 open or C133 shorted. (c) C126 or R121 open. (d) C125, C124 or C121 shorted.	2. (a) Test and replace if necessary. (b) Check with ohmmeter, replace if necessary. (c) Test by bridging a new part across the original part. Replace if necessary. (d) Check with ohmmeter, replace if necessary.
3. Receiver output and noise very low or completely dead.	3. (a) V81 through V87 defective. (b) Resistor or capacitor failure. (c) V51 or V52 defective.	3. (a) Check tubes, replace defective one. (b) Check voltages and resistances. Also check resistances of coils for failure. (c) Check tubes V51 and V52, replace defective tube.

Symptom	Probable trouble	Correction
	(d) Voltages and resistances not normal due to part failure. Check with VTVM.	(d) Isolate and replace defective part.
4. Rushing noise being received, but no signal from a transmitter (known to be operating on the receiver frequency).	4. (a) Trouble could be in the RF AMPL 152-174 MC plug-in unit, LOCAL OSC 152-175 MC plug-in unit, or the 1ST IF 7.8 MC plug-in unit. (b) The first h-f oscillator V31, or the second h-f oscillator V53 not oscillating.	4. (a) Check these units by substitution of units known to be in proper operating condition and aligned to the correct frequencies. Repair or align the defective unit, as required. (b) Check the control grids of these tubes with a VTVM. The voltage should be negative with respect to ground. If the reading is not negative, check the tubes, voltages and crystals.
5. No receiver signal output, but receiver noise exists.	5. (a) Failure of the LOCAL OSC plug-in unit. (b) Defective tubes V31, V32, V33. (c) Crystal Y31 defective. (d) Resistor, capacitor or coil failure. (e) Second h-f oscillator V53 not oscillating. Check pin 4 (grid) of V53 for a negative voltage. (f) Tube V3 defective.	5. (a) Follow instructions below. (b) Replace. (c) Replace. (d) Check circuit with a VTVM, replace defective part. (e) Check V53, crystal Y51, also check voltages on plate and screen. Isolate and replace defective part. (f) Replace.
6. Receiver output and noise lower than normal.	6. Leaky coupling capacitors C82, C84, C88, C90, C91 and C95.	6. Check with VTVM, replace defective capacitor.
7. Receiver noise is audible but sensitivity poor.	7. Tubes V1 or V2 defective. Resistor, capacitor or coil defective.	7. Check and replace defective tube. Check parts with a VTVM, replace.
8. Audio output from receiver weak, distorted, or both.	8. (a) Defect in audio amplifier stages of audio and squelch plug-in unit, or in discriminator circuit of the 2ND IF DISCR plug-in unit.	8. (a) Replace both of these units, one at a time. If one of them is faulty, test the tubes, voltages, and resistances.

1. VOLTAGE MEASUREMENTS TAKEN WITH A VTVM FROM CHASSIS TO TERMINALS AS INDICATED, RECEIVER OPERATING AND NO SIGNAL BEING RECEIVED.
2. RESISTANCE MEASUREMENTS TAKEN WITH PLUG-IN-UNIT REMOVED FROM RECEIVER BASE ASSEMBLY.

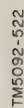


Figure 51. Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, terminal board voltage and resistance measurements.

74. Trouble-shooting Chart (contd)

Symptom	Probable trouble	Correction
9. Receiver will not unsquelch unless SQUELCH control is in OFF position.	(b) C126, C124, C122, C121 or C123 leaky.	(b) Unsolder one lead from each, test with ohmmeter, replace if necessary.
	(c) CR81 or CR82 open.	(c) Check front and back resistance with an ohmmeter, replace if necessary.
	(d) T81 out of alinement.	(d) Aline.
	9. V123 defective. Defective component in squelch circuit.	9. Replace. Check voltages and resistances.
10. Receiver will not squelch.	10. V124 defective. Defective component in squelch circuit.	10. Replace. Check voltages and resistances.
11. Audio output distorted when squelch disable switch is open.	11. V125 defective.	11. Replace.
12. Receiver blocks on strong signals, operates normally on weak ones.	12. Capacitor C12 or C32 shorted or leaky.	12. Replace.
13. Frequency of LOCAL OSC plug-in unit drifts.	13. (a) Crystal oven E31 not functioning properly. Check heater winding and thermostat.	13. (a) Replace defective part.
	(b) V34 defective, fails to glow.	(b) Replace.
	(c) Crystal Y31 defective.	(c) Replace crystal and check for drift.

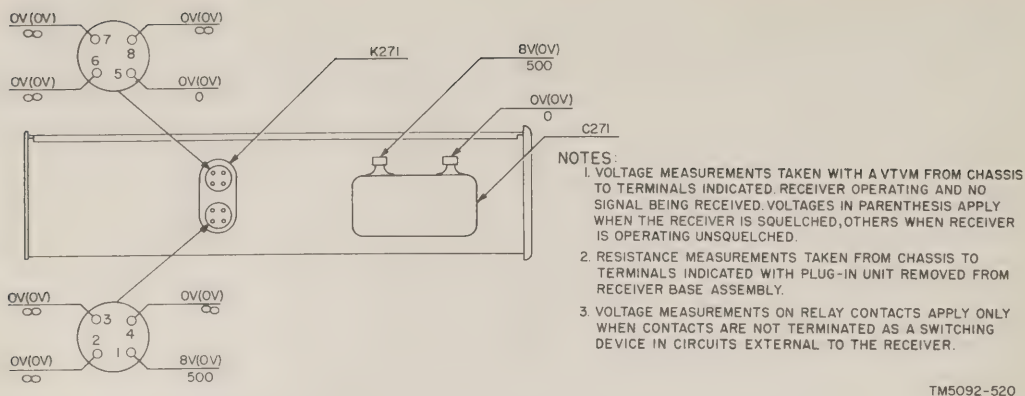


Figure 54. Radio Receiver R-394/U, RELAY plug-in unit, voltage and resistance measurements.

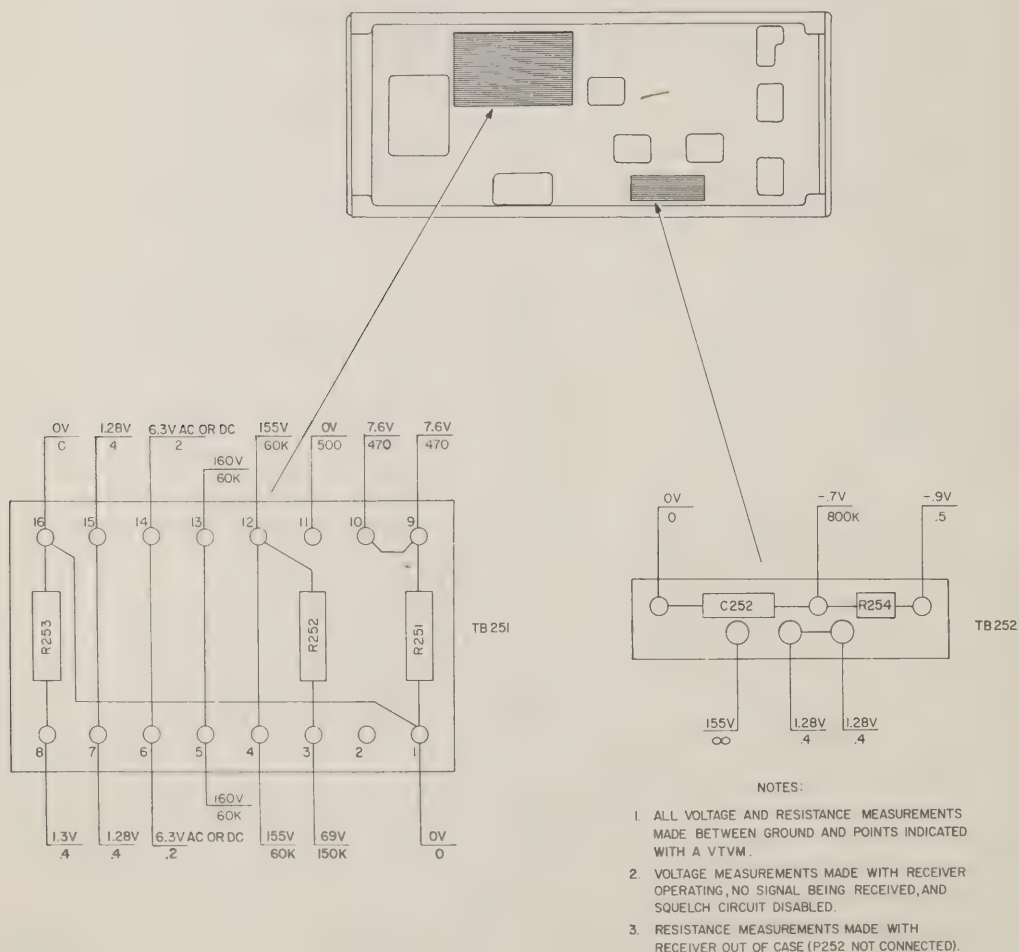


Figure 55. Radio Receiver R-394/U, voltage and resistance measurements of base.

75. Additional Trouble-shooting Information

a. D-c Resistance of Coils and Chokes in RF AMPL 152-174 MC Plug-in Unit.

Choke or coil	Terminals	Resistance (ohms)
L1 (Z1)	1-2	Less than .1
L2	Wire leads	Less than .1
L3 (Z2)	1-3	Less than .1
L4 (Z3)	1-3	Less than .1
L5	Wire leads	.47
L6	Wire leads	.7
L7 (Z4)	1-3	Less than .1
L8 (Z5)	1-3	Less than .1
L9	Wire leads	.47
L10	Wire leads	Less than .1
L11	Wire leads	Less than .1
L12 (Z6)	1-2	.32
L13	Wire leads	.47
L14	Wire leads	.47

b. D-c Resistance of Coils and Chokes in LOCAL OSC 152-174 MC Plug-in Unit.

Choke or coil	Terminals	Resistance (ohms)
HR31 heater	1-7	107.0
HR31 heater	3-7	5.7
L31 (Z31)	2-3	.60
L32	Wire leads	.32
L33	Wire leads	.72
L34	Wire leads	.47
L35	2-3	Less than .1
L36	2-3	Less than .1
L37	Wire leads	.32
L38	Wire leads	.70
L39	1-2	Less than .1
L39	2-3	Less than .1
L40	Wire leads	.70
L41	Wire leads	.70
L42	Wire leads	.80

c. D-c Resistance of Coils and Chokes in 1ST IF 7.8 MC Plug-in Unit.

Choke or coil	Terminals	Resistance (ohms)
L51 (Z51)	2-3	.32
L52 (Z52)	2-3	.32
L53 (Z53)	2-3	.32
L54 (Z54)	2-3	.32
L55 (Z55)	1-3	.45
L56	Wire leads	Less than .1
L57	Wire leads	Less than .1
L58	Wire leads	4.2

d. D-c Resistance of Chokes, Coils, and Transformers in 2ND IF DISCR Plug-in Unit.

Choke or coil	Terminals	Resistance (ohms)
L85 to L90 inclusive (coils in filament filter FL82, a potted unit).	A-1 A-2 A-3 A-4	.96 to 1.1 .72 to .83 .96 to 1.1 .72 to .83
L81 (Z81)	1-3	30.0
L82 (Z82)	2-3	28.0
T81	1-2	25.0
T81	3-4	43.0

e. D-c Resistance of Transformers and Chokes in AUDIO & SQUELCH Plug-in Unit.

Choke or coil	Terminals	Resistance (ohms)
T121	1-2	500.0
T121	3-4	.50
L121	Wire leads	.46

f. D-c Resistance of the Relay Coil in Relay Plug-in Unit.

Relay coil	Terminals	Resistance (ohms)
K271	1-5	500.0

76. Directions for Signal Substitution

a. Signal substitution (pars. 77 through 82) require a source of audio, i-f and/or r-f signals. Use a signal generator which will produce desired signal required in any specific test (par. 66).

b. A VTVM and a tube tester also are needed to isolate the defective parts after the faulty stage has been indicated by signal substitution.

c. In the tests indicated in paragraphs 77 through 82, ground one side of the signal generator output to the receiver chassis, and connect the other side through a capacitor, as instructed in the specific test, to the points in the receiver under test.

d. Note the volume obtained, and listen for serious distortion or abnormal noise. When working back through the receiver from the audio output stage towards the input stages, reduce the signal generator output as required in order to eliminate the possibility of forcing a signal through a defective

circuit. If a similar receiver, in good operating condition, is available, compare the results obtained from the receiver being tested with the receiver known to be operating properly.

e. Should a certain point in the receiver which requires signal injection be difficult to touch with the test probe or clip, select another point directly connected to the first point. Such a test may be at the junction of two resistors, two capacitors, or on a terminal board. The serviceman must use his own judgement when such a circumstance arises.

f. Use extreme care when probing in the receiver. Connections and parts are small and in very close proximity with other parts. Check the wiring and solder connections while testing by signal substitution. A poor solder connection or similar fault may be the trouble being investigated.

77. A-f Tests

Note. Before attempting any of the tests, be sure the SQUELCH disable switch in the control unit is in the OFF position. Set the VOLUME control in the control unit to the extreme clockwise position.

a. *Terminal 5 of V122 (Plate of Audio Power Amplifier).* Apply an audio signal through a series capacitor (approximately .05 uf) to terminal 5 of V122. If the output of the audio generator is sufficient, an audio tone should be heard in the loudspeaker. If no audio signal is heard, inspect the audio output connections from the loudspeaker back to the audio output transformer, T121. Check this transformer for an open winding, also for a shorted capacitor C133.

b. *Terminal 1 of V122 (Grid of Audio Power Amplifier)* Place the audio signal from the signal generator on terminal 1 of V122. Reduce the audio output from the a-f generator if the volume becomes excessive. There should be a noticeable increase in volume as compared with the previous test. If no volume increase is obtained, or no audio signal is heard, check tube V122. If the tube tests are satisfactory, check the plate and screen voltages of V122. If these tests reveal no fault, check the 470-ohm resistor R253 on TB251 in the receiver base. If the receiver uses the 500-ohm winding of relay K271 as the cathode resistance check this winding for an open circuit.

c. *Terminal 1 of V121 (Plate of 1st Audio Amplifier)* Apply the audio signal to pin 1 of V121. If no audio signal is heard, check capacitor C126. If the audio signal is greatly reduced as compared with that of the previous test, advance potentiometer R127 clockwise, noting any increase in volume (mark setting of R127 before performing this step). If the volume increase is erratic, check potentiometer R127.

d. *Terminal 4 of V121 (Grid of 1st Audio Amplifier).* Apply the audio signal to pin 4 of V121. The audio signal should be greatly increased as compared with that

of the previous test. If the audio tone from the loudspeaker is excessive, reduce the output from the a-f generator. If no volume increase is apparent, or no audio output is obtained, check tube V121. If the tube tests satisfactorily, check the plate and screen voltages of V121; also check the cathode resistors R123 and R124.

e. *Junction of C127 and R121 (Audio Input to AUDIO & SQUELCH Plug-in Unit)* Inject the audio signal from the signal generator at the junction of C127 and R121 and listen for the audio tone in the loudspeaker. Should there be no output, check C121, and C122, and R121. If this check reveals no fault, check R122 and C123. As a final check on the audio section unit, break the connection to terminal R on P121. If audio noise can be obtained by injecting the signal generator at the junction of C127 and R121 the trouble probably is in the connection between the AUDIO & SQUELCH plug-in unit and the 2ND IF DISCR plug-in unit, or in the 2ND IF DISCR plug-in unit.

f. *Junction of Terminal R on P82 and Low-pass Filter FL81 (Audio Output in the 2ND IF DISCR Plug-in Unit).* Apply the audio signal from the signal generator to the junction of terminal R on P82 and the low pass filter FL81. If an audio signal is heard in the loudspeaker, apply the audio signal to the second terminal on FL81 (not the grounded one). If at this point no audio is obtained, check low pass filter FL81.

78. Squelch Test

a. *Test Set-up.*

- (1) Set the SQUELCH control almost to the extreme clockwise position, but do not advance it so far that the squelch disable switch is switched to the OFF position.
- (2) Connect the audio oscillator between ground and junction of C127 and R121. Adjust the audio oscillator to deliver 12,000 cps. Connect an a-c VTVM across the audio oscillator. Connect a d-c VTVM between ground and terminal 1 of V122.

b. *Squelch Circuit Test.* Set the audio oscillator attenuator control for zero output. The reading on the d-c VTVM should be about .25 volt negative. Slowly advance the output attenuator control on the audio oscillator until the needle suddenly jumps up to approximately a negative 25 volts. At this point take a reading on the a-c VTVM. The reading should be between 2.5 and 4.0 volts rms (root-mean-square). Note the reading just obtained and slowly decrease the output from the audio oscillator. When the d-c VTVM reading suddenly drops to approximately .25 volt negative, again read the a-c VTVM. This voltage should be 1/2 volt rms (root-mean-square) less than the 12,000 cps voltage required to squelch the audio tubes.

c. *Trouble Shooting Squelch Circuit.* Refer to paragraph 59 for squelch circuit theory. When the audio tubes are unsquelched, noise amplifier tube V123 and squelch clamp tube V125 are conducting heavily as evidenced by the large voltage drops across their respective plate resistors. When the audio tubes are squelched, the squelch tube V124 conducts heavily as evidenced by the low plate voltage. Reference to the voltage and resistance data in figures 52 and 53 will be of assistance in trouble shooting the squelch circuit. Possible sources of trouble other than tubes or the germanium diode CR121 are the numerous series-connected resistors in this circuit. An open resistor or one that has changed in value appreciably will be a definite source of trouble.

d. *Alternate Squelch Test.* Another method of checking the operation of the squelch circuits consists of measuring the plate voltage of noise amplifier V123, squelch tube V124, and squelch clamp V125 as the 12,000-cps test signal is turned on and off. The voltages should agree approximately with the voltages given in figures 52 and 53.

79. I-f Tests

a. 2ND IF DISCR Plug-in Unit.

- (1) *Control Settings.* Set the SQUELCH control in the OFF position. Set the VOLUME control in the full clockwise position.
- (2) *Terminal 1 of V87 (2d limiter plate).* Apply a 455-kc, frequency-modulated ± 15 -kc signal to ground and terminal 1 of V87 through a small mica capacitor of approximately 500 uuf. Use 1,000 cps as the modulating frequency. Advance the output of the signal generator until the 1,000 cps tone is heard in the loudspeaker. If no signal is heard in the speaker, check the discriminator transformer T81 primary and secondary windings for an open winding. Also check the germanium diodes CR81 and CR82.
- (3) *Terminal 4 of V87 (2d limiter control grid).* Inject the f-m signal at pin 4 of V87. Reduce the output of the signal generator if necessary. Should this test fail to produce any audio output or result in decreased audio output, check 2d limiter V87. If the tube is satisfactory, return it to its socket and measure the plate and screen voltages.
- (4) *Terminal 1 of V86 (1st limiter plate).* Apply the test signal to pin 1 of V86. The 1,000-cps tone should be approximately the same amplitude as in the preceding test. Should there be a decrease in volume, or no output at all, check coupling capacitor C95 by bridging a similar capacitor across it.
- (5) *Terminal 4 of V86 (1st limiter control grid).* Apply the 1000 cps f-m test signal to pin 4 of V86. If the test fails, check the tube, and the plate and screen grid voltages. If the plate voltage is zero, or very low, check coil assembly Z82 for possible failure.
- (6) *Terminal 1 of V85 (5th 455-kc i-f amplifier plate).* Apply the test signal to pin 1 of V85 and compare the audio output obtained from the previous test. They should be approximately the same. If the output is reduced or absent, check the coupling capacitor C91 for an open by bridging a similar capacitor across it.
- (7) *Terminal 4 of V85 (5th 455-kc i-f amplifier control grid).* Inject the test signal at pin 4 of V85. The audio signal heard in the loudspeaker should increase in volume. If no increase is obtained, check the tube. If the tube is satisfactory, check tube voltages while noting any irregularity in the results obtained.
- (8) *Terminal 1 of V84 back through and including terminal 4 of V81.* Continue testing tube socket voltages in the manner described above. The audio output should increase each time the test signal is transferred from the plate to the grid of any tube in the 455-kc i-f amplifier. Note the following:
 - (a) The absence of plate and/or screen grid voltages can be caused by open resistors or shorted bypass capacitors.
 - (b) Positive control grids indicate leaky or shorted coupling capacitors, or a gassy tube.
 - (c) Should plate or screen grid voltages be absent or low, refer to the Receiver R-394/U schematic diagram (fig. 76), and the B+ distribution diagram (fig. 43).
 - (d) Sometimes tubes develop short circuits and upset the plate and screen grid voltage readings. Be sure this is not the case before trouble shooting for defective capacitors or resistors.

b. 1ST IF 7.8 MC Plug-in Unit.

- (1) *Terminal 1 of V52 (2d mixer plate).* Apply the 455-kc f-m test signal to pin 1 of tube V52. The audio output heard in the speaker should be of approximately the same volume as that obtained when applying the same signal to pin 4 of tube V81 in the 2ND IF DISCR plug-in unit. If this test fails, the fault possible will be in coil assembly Z55 or in the coaxial connections between the plug-in units.

(2) *Terminal 4 of V52 (2d mixer control grid).* Apply a 7.8-mc signal, frequency-modulated ± 15 kc with a 1,000-cps audio voltage to pin 4 of V52 through a small mica capacitor. If this test fails, check V52, and the plate and screen voltages of this tube. If these checks produce no evidence of trouble, test 2d h-f oscillator V53. If the tube is satisfactory, check the plate, screen and control grid voltages. A negative reading on the control grid indicates that the tube is oscillating. Do not discount the possibility of the crystal Y51 being defective. If necessary, replace the crystal with one known to be good, and then check for a negative voltage on the control grid of V53.

(3) *Terminal 1 of V51 (7.8-mc i-f plate).* Inject the 7.8-mc signal to pin 1 of V51. If the test fails, check the three coupling capacitors C58, C60, and C62 by injecting the 7.8-mc signal on their tie points while working towards second mixer V52.

(4) *Terminal 4 of V51 (7.8-mc i-f control grid).* Apply the test signal to pin 4 of V51. A marked increase in volume should be noticed. Should the test fail, check V51. Check the plate and screen grid voltages if the tube is satisfactory.

80. R-f Tests

a. Terminal 4 of V3 (Grid of 1st Mixer). Tune the signal generator to the receiver frequency and inject a strong signal frequency modulated ± 15 kc with 1,000 cps at terminal 4 of V3 through a small mica capacitor (100-uuf). If no audio is heard in the speaker, increase the output of the signal generator and rock the signal generator frequency above and below its initial setting. If no audio is obtained, or the signal is weak, check V3. If the tube is satisfactory, check its plate and screen voltages.

b. Terminal 1 of V2 (Plate of 2d R-f Amplifier). If the signal injection test in the preceding subparagraph indicates that the trouble is ahead of 1st mixer V3, tune the signal generator to the receiver frequency and inject a signal on terminal 1 of V2. If this test suggests a failure, check coupling capacitor C21 and coil assemblies Z4 and Z5. Also check capacitors C30 and C31 for possible short circuit.

c. Terminal 4 of V2 (Grid of 2d R-f Amplifier). Apply the r-f signal to terminal 4 of V2. An increase in receiver output should be noticeable. If this is not the case, test V2. Return the tube to its socket if it is satisfactory and check tube voltages and resistances.

d. Terminal 5 of V1 (Plate of 1st R-f Amplifier). Inject the r-f signal into terminal 5 of V1. The response

should be comparable with that of the preceding test. If not, check coupling capacitor C20, coil assemblies Z2 and Z3, and capacitors C28 and C29.

e. Terminal 1 of V1 (Grid of 1st R-f Amplifier). Apply the r-f signal to terminal 1 of V1. An increase in receiver output should be noticeable. If a failure is apparent in this stage, check the tube voltages and resistances. Proceed to the antenna input connector P1 and apply the signal at this point. If the receiver gain drops off, trouble may be located in coil assembly Z1 or in connector P1.

81. Agc Test

a. Radio Receiver R-394/U uses an agc circuit which applies a negative bias to the control grids of r-f amplifiers V1 and V2. This bias is proportional to the signal strength of the received signal. The 5th 455-kc i-f amplifier develops this bias at its control grid. A portion of this bias is fed back to the r-f amplifiers through an RC (resistance and capacitance) network which is designed to filter out a-c pick-up such as that resulting from ignition noise or similar types of interference.

b. Connect the signal generator to antenna input connection P1 and a d-c VTVM to the test points marked 2ND IF and GND on the front of the receiver. With the signal generator tuned to the receiver frequency and set at zero output, note the reading on the VTVM. Increase the output from the signal generator to maximum. The agc bias should increase also. Check this bias with a VTVM at the low end of the grid return resistors (R2 and R4) of V1 and V2 respectively. In the event that this bias is not apparent at the tubes one of the components in the agc RC network, capacitors C12, C32, C252, or C85, or resistors R254 or R88 may be defective. Absence of agc voltage causes serious receiver overloading.

82. Stage Gain Charts

a. General. Stage gain measurements allow a check on the gain of individual stages in the receiver. In trouble shooting, the measurements serve to locate the defective stage, which may be operative, but low in signal output. The test signals injected into particular parts of the circuit are adjusted to develop a predetermined output signal either in the form of an audio output signal or the bias voltage developed across the grid resistor of the fifth 455-kc i-f amplifier. As the source of test signal is moved from the output circuits toward the antenna input circuit of the receiver, less test signal voltage should be required to develop the required output. The receiver has no controls except the screw-driver-adjusted audio volume control (R127) in the AUDIO AND SQUELCH plug-in unit.

b. Test Conditions.

- (1) Use a 115- or 230-volt a-c power supply (Power Supply PP-846/U). Adjust the line voltage to 115 or 230 volts.
- (2) Allow the receiver and test equipment to warm up for at least 10 minutes.
- (3) Turn the audio gain control (R127) in the AUDIO AND SQUELCH plug-in unit fully clockwise (maximum gain).
- (4) Turn the SQUELCH control in the control unit to the OFF position.
- (5) The stage gain of individual stages should fall within the limits specified below. The limits are broad enough to accommodate variations in the quality of replacement tubes. However, the over-all sensitivity of the receiver should be better than .5 microvolt, as pointed out in the final testing section.

c. Audio Stage Gain Chart. Connect an 8-ohm load across the secondary (terminals 3 and 4) of the audio output transformer T121. The VOLUME control circuit and loud speaker in Electrical Equipment Cabinet CY-1150/U will apply the 8-ohm load if this cabinet is used. Also connect a power output meter across terminals 3 and 4. If the power output meter supplies the 8-ohm audio load, no additional speaker circuit or resistor loading should be used. Connect a high impedance a-c VTVM across the output terminals of the audio oscillator. Feed the 1,000-cps audio test signal to the points indicated. Use resistor R253 (470 ohms) as the cathode bias resistor of tube V122. If the squelch relay K271 is wired in as the cathode bias resistance, move the jumper on TB251 from terminals 10 and 11 to terminals 9 and 10.

Input connection	Input voltage (volts)		Power at T121 secondary (watts)
	min.	max.	
Pin 1 of V122	6.1	13.6	.5
Pin 4 of V121	.073	.165	.5
Terminal R of P121	2.0	4.4	.5
Junction of R112 and FL81	2.4	5.4	.5

d. 455-kc I-f Stage Gain Chart.

- (1) Connect a d-c VTVM to the receiver test points marked GND and DISCR. Connect

the i-f signal generator to pin 4 of V84 through a 1,000 uuf (micromicrofarad) mica capacitor. The d-c VTVM should read +1 volt when the signal generator is tuned to 455 kc (unmodulated), indicating correct alignment of the discriminator. As the signal generator is varied above and below 455 kc, the needle on the VTVM should swing rapidly positive and negative. Use a test signal which will develop a negative 3 volts at the test point 2ND IF. Vary the i-f signal frequency above and below 455 kc. The discriminator output voltage (measured at the DISCR test point) should swing between the limits of 20 and 30 volts plus and minus. A larger test signal should not change these limits because of the limiting action of V86 and V87. Stage gain tests on these two stages indicate limiting action by observing the increasing grid-leak bias developed at the grids of V86 and V87 as the input test signal is increased. A test point at the grid of V87 is decoupled at the junction of R101 and C96.

- (2) Connect the d-c VTVM to the receiver test points marked GND and IF. Output voltage is measured at the control grid of V85 through the decoupling filter consisting of R99 and C92. Adjust the output of the unmodulated 455-kc i-f test signal to obtain a -3-volt reading on the VTVM. Test the gain of the 455-kc i-f stages as follows:

Input connection	Input voltage (uv)		Output at 2ND IF
	min.	max.	
Pin 4 of V84	27,000	61,500	-3 volts
Pin 4 of V83	7,500	16,900	-3 volts
Pin 4 of V82	830	1,870	-3 volts
Pin 4 of V81	93	210	-3 volts
Pin 4 of V52	24	54	-3 volts

e. 7.8-mc I-f Stage Gain Chart. Use the same VTVM connection used for the 455-kc i-f tests. Feed an unmodulated 7.8-mc i-f test signal to the circuits indicated through a 1,000-uuf mica capacitor.

Input connection	Input voltage (uv)		Output at 2ND IF
	min.	max.	
Pin 4 of V51	32	72	-3 volts
Pin 4 of V3	11	25	-3 volts

f. R-f Stage Gain Chart. Couple in an r-f test signal of 152 to 174 mc as listed in chart below through a 100-uuf mica capacitor. Be careful not to disturb any of the wiring in the RF AMPL 152-174 MC plug-in unit. The accuracy of the test at pin 4 of V2 will depend on the amount of detuning and circuit loading resulting from the test connection at this point. Keep the mica capacitor as close to pin 4 of V2 as possible. When feeding the test signal into the antenna input circuit (terminal 3 of Z1 or the antenna input connector of Electrical

Equipment Cabinet CY-1150/U) the output impedance of the signal generator must be 50 ohms.

Input connection	Input voltage (uv)		Output at 2ND IF
	min.	max.	
Pin 4 of V2	8	18	-3 volts
Terminal 3 of Z1	.33	.75	-3 volts

Section II. REPAIRS

83. Special Tools Required for Replacement of Subminiature Parts

a. No special tools are shipped with Radio Receiver R-394/U. The smallest general purpose radio tools available are most suited for the repair of this receiver. Such tools as needle-nose pliers and small diagonal cutters are more useful than the ordinary radio long-nose pliers and cutters.

b. The tips on the test probes used for testing and alining this receiver should be kept clean. If possible, a point should be filed on the end of each probe tip in order to contact the parts being tested without exerting a force which could result in a broken part or wire.

84. Replacement of Parts

a. General. Refer to figures 56 through 68 for locations of the parts in the assemblies of Radio Receiver R-394/U.

b. Subminiature Tubes. Exercise care when removing the subminiature tubes. Lift them straight up away from the socket. When replacing the subminiature tubes be sure the red dot on the tube lines up with the red dot on the chassis. New subminiature tubes have long wire leads which must be cut to the proper length. Use the tube being replaced as a guide for the proper length of the wire leads. Terminal numbers on the tubes begin with number 1 at the red dot and progress to number 5. When replacing V3, refer to paragraph 43c.

c. Coaxial Connectors of Plug-in Units. Loosen and remove four flat head screws on the bottom plate of the plug-in unit. This releases the bottom plate and the coaxial connector can be removed after first unsoldering and removing the cable or wire attaching to it.

d. R-f Bypass Capacitors with Solder Lugs. There are eight r-f bypass capacitors on the RF AMPL 152-174 MC plug-in unit which are soldered to the chassis. Unsolder the wire leads connected to them, and then heat up the lugs fastening them to the chassis.

Exercise care when performing this operation so that other parts are not burned by the soldering iron. Replace the new bypass capacitor by first soldering it to the chassis and then connecting the wires removed from the original one.

e. R-f and I-f Coils and Shield Cans. If the replacement of one of the r-f or i-f coil shield cans becomes necessary, proceed as follows:

- (1) Unsolder all wires, capacitors, and resistors connected to the coil assembly.
- (2) Remove the coil from the coil shield by removing the screws which retain it. Replace the coil with a new one if it is damaged.
- (3) Remove all tubes in the vicinity of the coil shield to be replaced.
- (4) Remove the original defective coil shield by cutting it away at its base. Use diagonal cutters or any tools capable of this function. Be sure no sharp edges remain. Use a small file to remove burrs.
- (5) The replacement coil shield will be mounted with two spade-type lugs or studs. Measure, mark, and drill two holes on the plug-in unit for mounting this replacement coil shield. Be careful when drilling so that no other parts are damaged. Remove any metal chips caused by drilling, or filing.
- (6) Install the new coil shield and secure with nuts and lockwashers.
- (7) Insert the coil, noting correct positioning so that wires previously removed will fit.
- (8) Reconnect wires, capacitors, and resistors.
- (9) Check alinement of this plug-in unit.

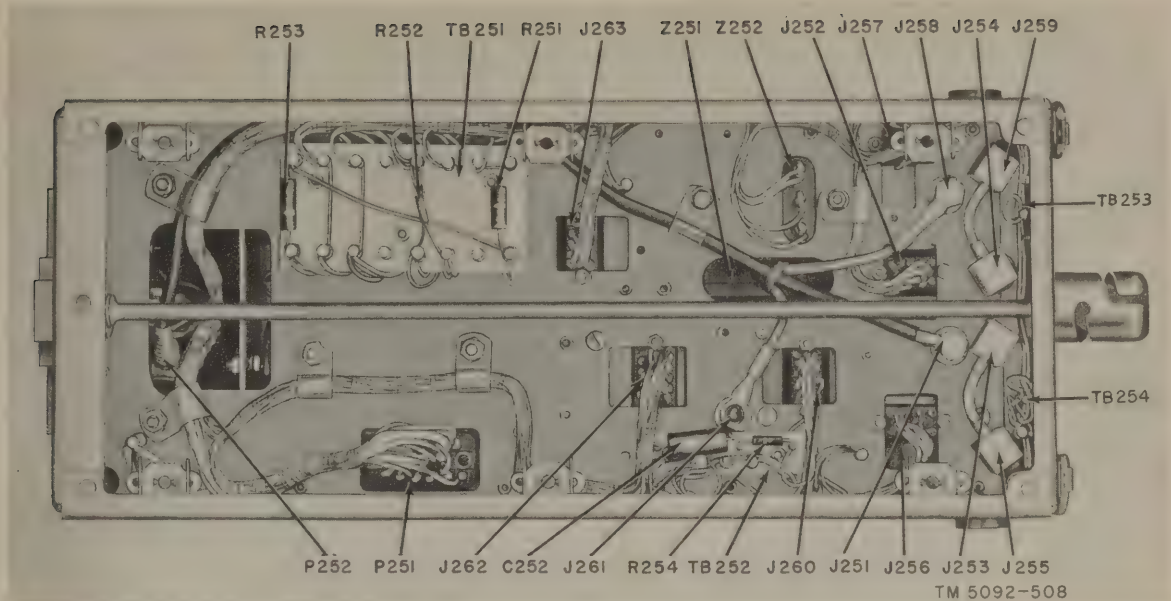


Figure 56. Radio Receiver R-394/U, base, bottom view.

85. Disassembly of Terminal Boards from Plug-in Units

In the event that replacement of one of the terminal boards becomes necessary observe the following precautions:

a. Unsolder the wires, capacitors, resistors and coils which connect to terminals on the terminal board from points not on the terminal board. Ex-

ercise extreme caution so that other terminals, especially on the subminiature tube sockets, are not broken or damaged. Tag each lead wire or group of wires so that they will be properly wired when the new terminal board is installed.

b. If the terminal board being replaced is one which contains numerous terminals draw a pencil sketch of the board, numbering each terminal with

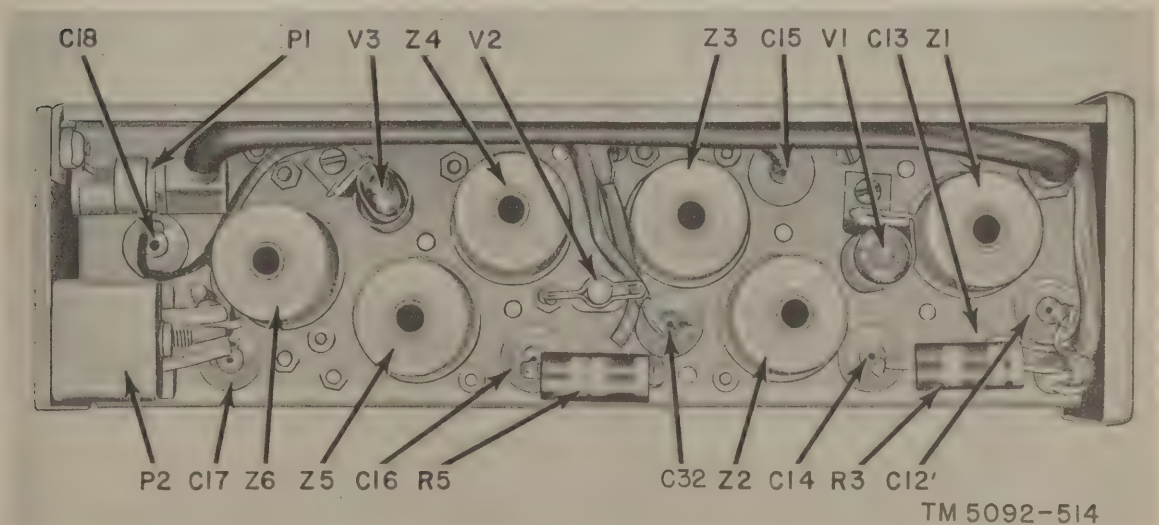


Figure 57. Radio Receiver R-394/U, RF AMPL 152-174 MC plug-in unit, top chassis view.

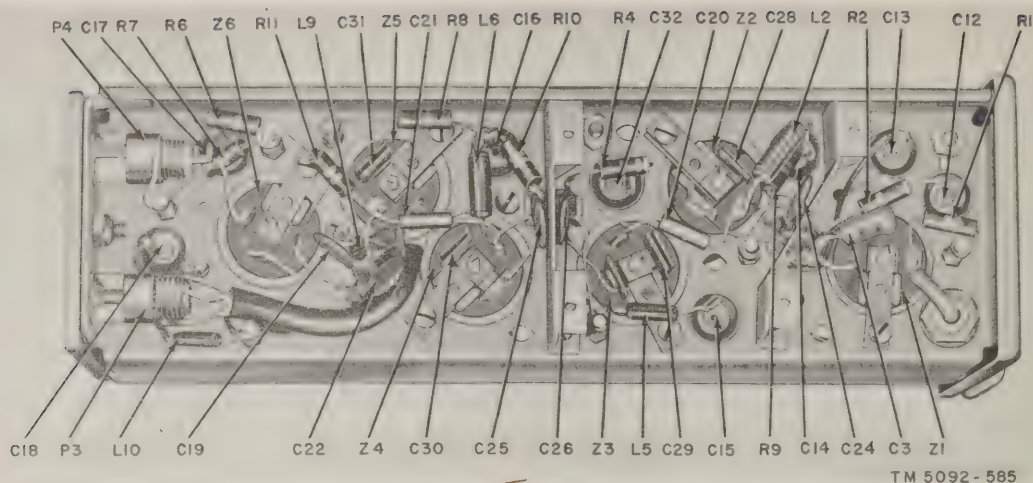


Figure 58. Radio Receiver R-394/U, RF AMPL 152-174 MC plug-in unit, bottom chassis view.

numbers which will agree with the numbers on the tagged wire leads.

c. If it is necessary to replace a part on one of the terminal boards and the part is difficult to remove because of its location in the plug-in unit, remove the attaching parts of the terminal board

and move it slightly in such a way as to make the part to be replaced more accessible.

86. Refinishing

Instructions for refinishing are given in TM 9-2851.

Section III. ALINEMENT AND ADJUSTMENT PROCEDURES

87. General Alinement Precautions

a. Before attempting any alinement of the receiver, be certain that alinement is necessary. If the sensitivity of the receiver is below that which is required, the trouble may be due to weak tubes

or other circuit defects. If a complete alinement of the receiver is necessary, the 455-kc alinement must be done first, and then the 7.8-mc i-f alinement; next the circuits in the LOCAL OSC 152-174 MC plug-in unit; and finally the r-f circuits in the RF AMPL 152-174 MC plug-in unit. If the 455-kc

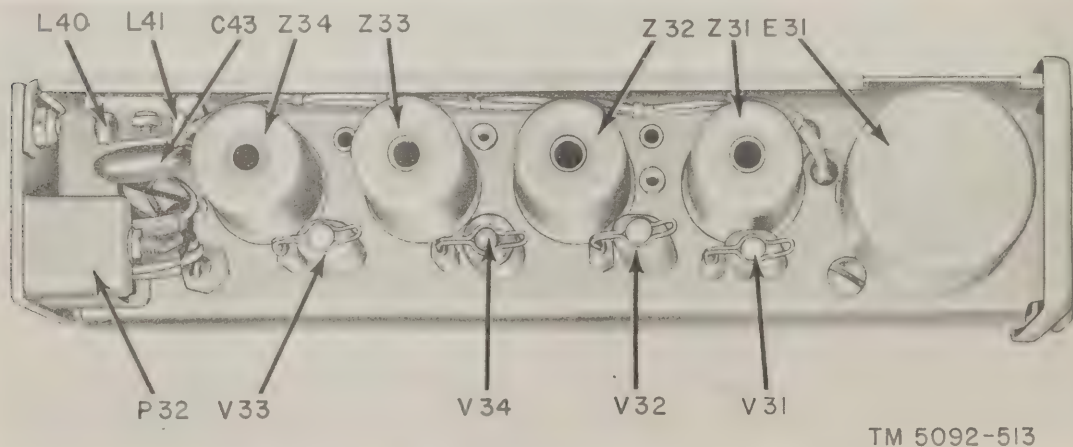


Figure 59. Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, top chassis view.

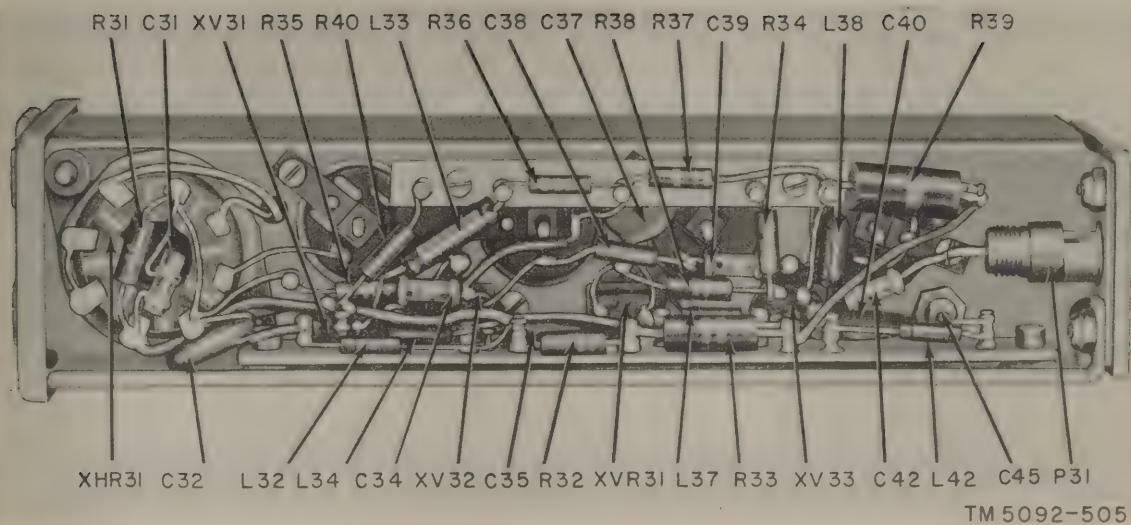


Figure 60. Radio Receiver R-394/U, LOCAL OSC 152-174 MC plug-in unit, bottom chassis view.

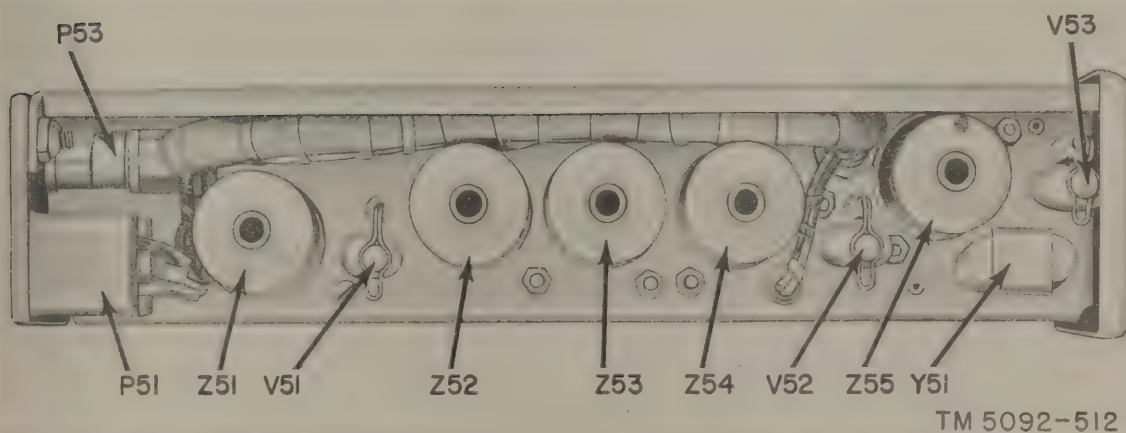


Figure 61. Radio Receiver R-394/U, 1ST IF 7.8 MC plug-in unit, top chassis view.

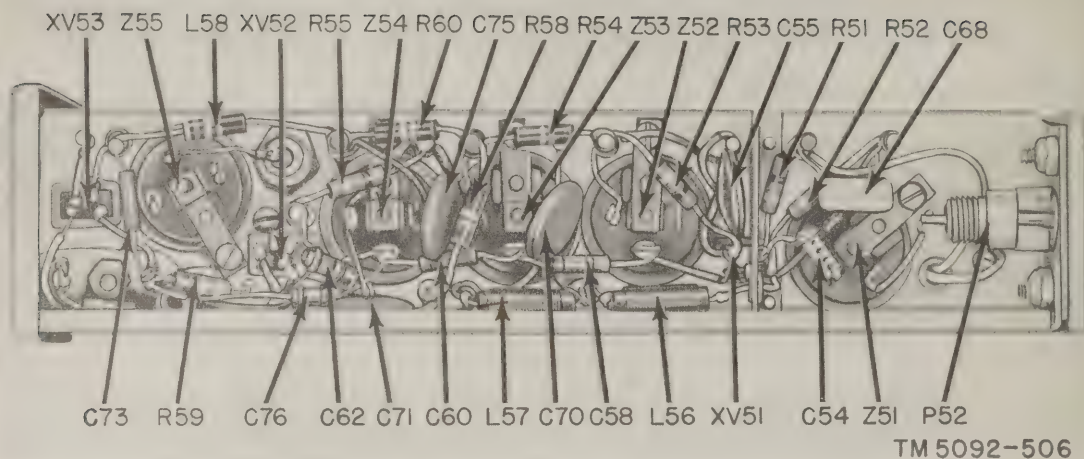


Figure 62. Radio Receiver R-394/U, 1ST IF 7.8 MC plug-in unit, bottom chassis view.

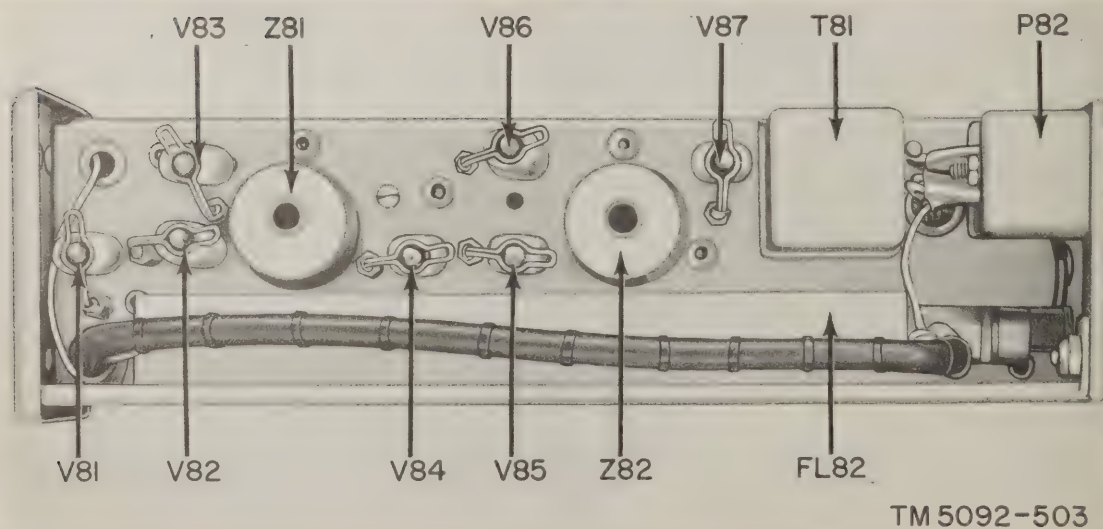


Figure 63. Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, top chassis view.

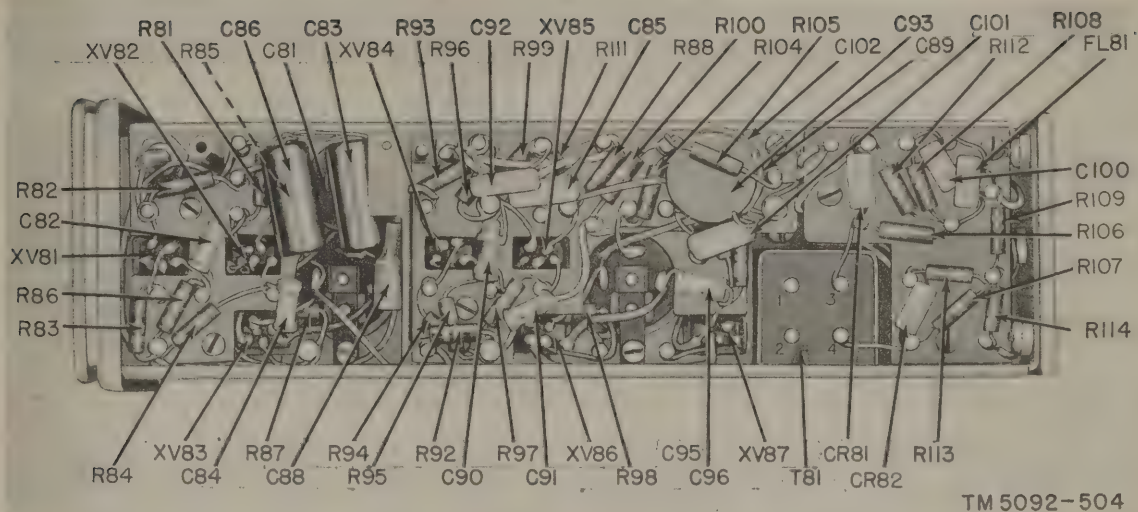


Figure 64. Radio Receiver R-394/U, 2ND IF DISCR plug-in unit, bottom chassis view.

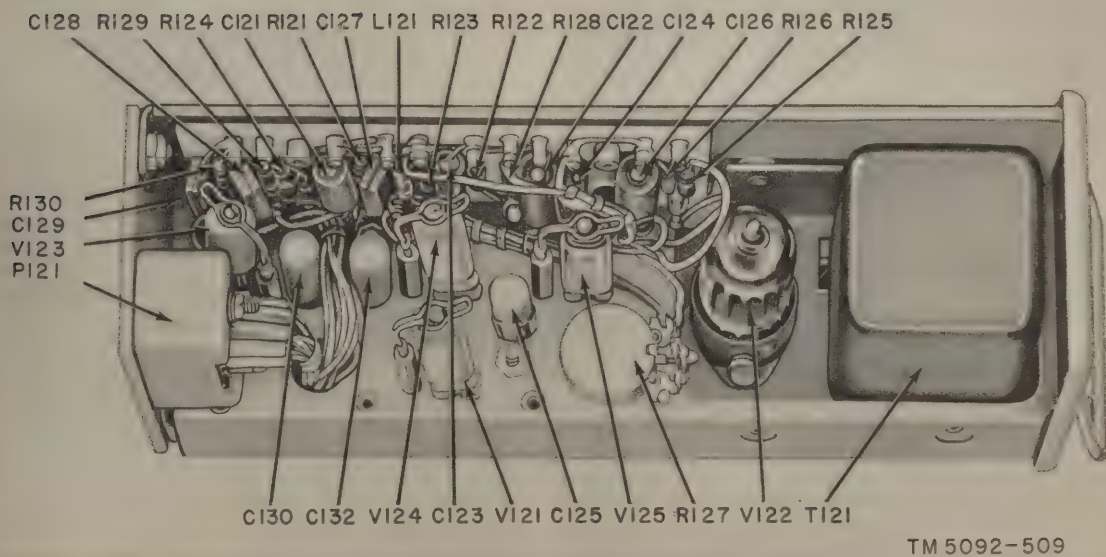
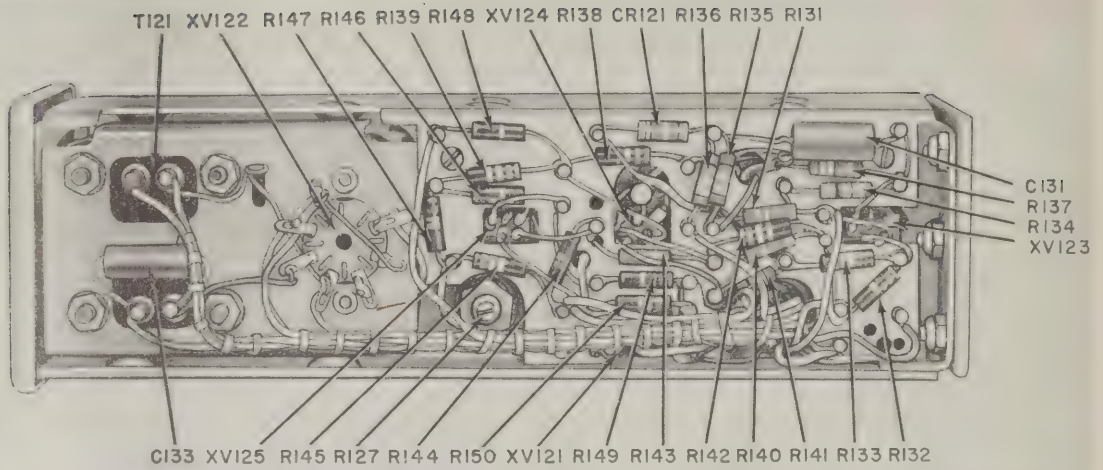
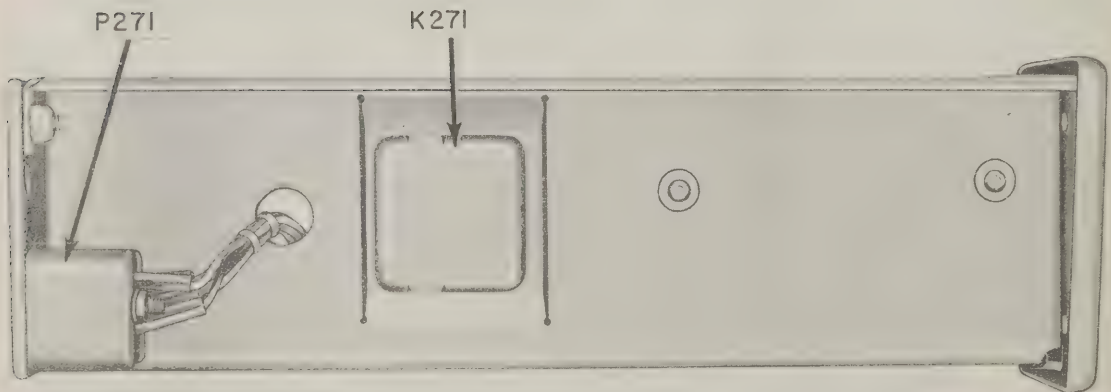


Figure 65. Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, top chassis view.



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Figure 66. Radio Receiver R-394/U, AUDIO & SQUELCH plug-in unit, bottom chassis view.



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Figure 67. Radio Receiver R-394/U, RELAY plug-in unit, top chassis view.

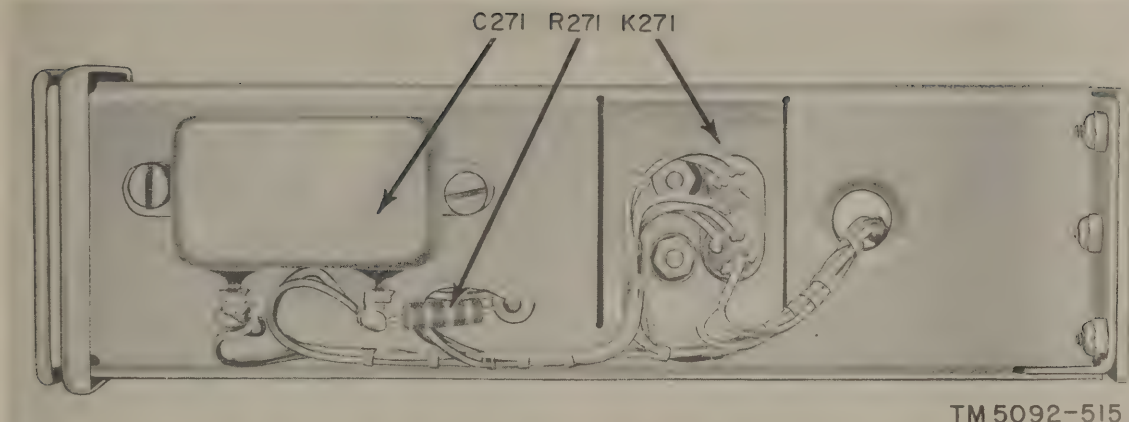


Figure 68. Radio Receiver R-394/U, RELAY plug-in unit, bottom chassis view.

i-f circuits are not aligned properly, subsequent alignments will be incorrect also. It is recommended that the frequency settings of the signal generator be checked with a frequency standard such as Frequency Standard TS-174/U.

b. The RF AMPL 152-174 MC plug-in units use four gimmick capacitors C28 through C31 which are used for adjusting the tuning range of the r-f tuned circuits. These gimmicks are small brass tabs which are factory adjusted by varying the spacing between tabs. When performing any work on this plug-in unit be careful not to disturb the tabs.

88. Test Equipment Required for Alinement

a. *Signal Generators.* The signal generator required for r-f alinement, such as the Boonton Radio Corporation model 202B, must cover the frequency range of 152 to 174 mc and be capable of delivering a signal frequency modulated at least ± 15 kc (deviation) with a 1,000-cps audio signal. The output should be accurately calibrated from 0 volt up to 1 volt with a low impedance connection such as 50 ohms. The i-f signal generator (RF Signal Generator Set AN/URM-25 or Signal Generator TS-588/U or equivalent) should be capable of delivering the two i-f frequencies, 455 kc and 7.8 mc, frequency-modulated ± 15 kc (deviation) with a 1,000-cps audio signal.

b. *Output Meter.* The output meter used for determining the audio power output of the receiver (Output Meter TS-585/U or equivalent) should have an input impedance of 8 ohms (which matches the secondary impedance of the audio output transformer T121). A Multimeter ME-6/U in parallel with an 8-ohm load resistor can be used in place of the power meter. The maximum audio power developed by the receiver will seldom be in excess of ap-

proximately .5 watt. Therefore any meter that will give accurate readings from this .5-watt level down to and including zero will be satisfactory.

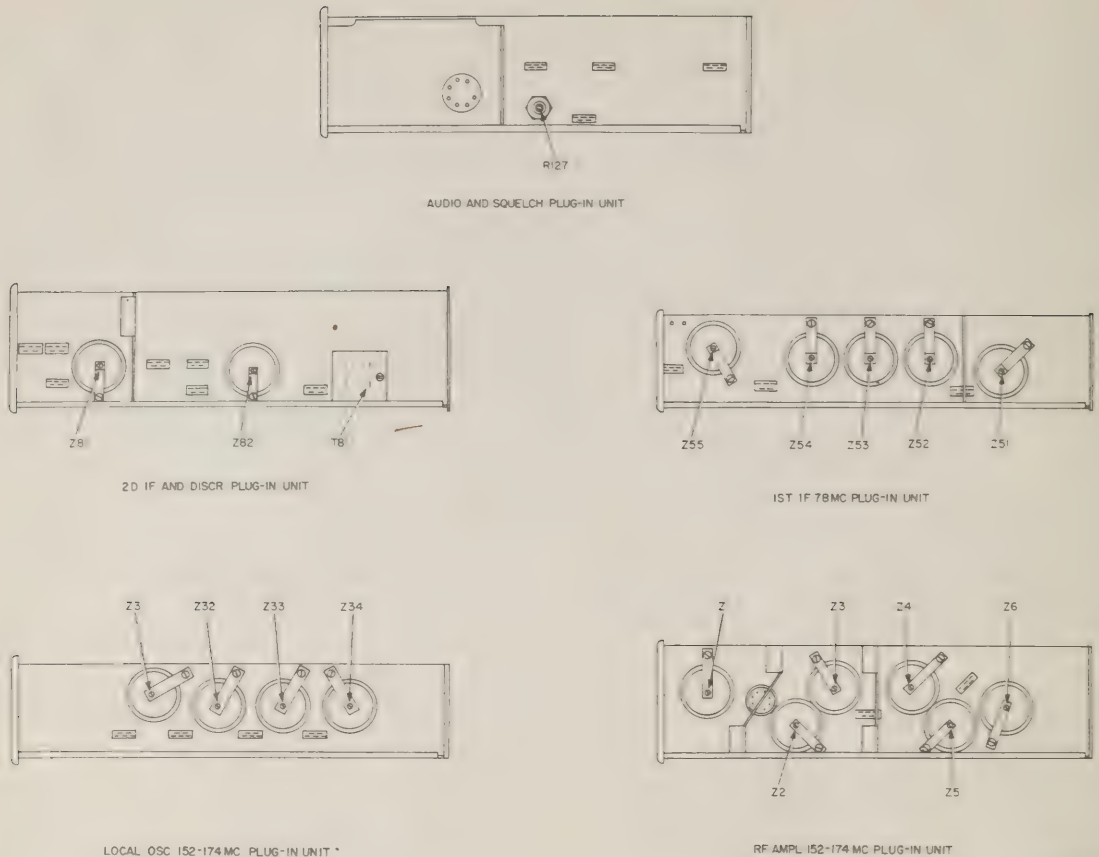
c. *Frequency Standard.* The practice of calibrating the signal generator with an accurate frequency standard, such as Frequency Standard TS-174/U, is required. Such practice as this assures accurate alinement.

d. *D-c Vacuum Tube Voltmeter.* A d-c vacuum tube voltmeter (VTVM) is also required for the alinement as well as trouble shooting. The hot lead should be shielded in order to minimize r-f pick-up. This d-c VTVM is used for measuring voltages across high resistance circuits. Because of its high input impedance (over 10 megohms), the loading of the circuit due to the VTVM input impedance is negligible. Electronic Multimeter TS-505/U or equivalent is recommended for this purpose.

e. *A-c Vacuum Tube Voltmeter.* An a-c VTVM (Electronic Multimeter ME-6/U or equivalent) is necessary for measuring audio voltages pertaining to tests and adjustment of the AUDIO and SQUELCH plug-in unit. As in the case of the d-c VTVM, the high input impedance of this VTVM is highly desirable.

f. *Audio Oscillator.* An audio oscillator (Audio Oscillator TS-382/U or equivalent) capable of producing audio signals from 20 cps to 20,000 cps is required for testing and adjusting the AUDIO & SQUELCH plug-in unit. Audio voltages in excess of 4 volts should be obtainable from this audio oscillator.

g. *Distortion Analyzer.* A distortion analyzer is required for the purpose of adjusting the audio gain control R127 on the AUDIO & SQUELCH plug-in unit. This instrument also is required for final



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Figure 69. Radio Receiver R-394/U, alinement points.

testing of the receiver. Sound Analyzer TS-615/U is recommended for this purpose.

b. Alinement Tool. A special alinement tool is required for adjusting the slugs in the various coil assemblies used in the receiver. The alinement tool has a hollow head which engages the adjusting screw in a manner which prevents the tool from slipping off the screw.

89. Alinement Procedures

a. The alinement of Radio Receiver R-394/U can be done with the receiver connected to its case with a patch cord. Remove the shield covers which slip over the individual plug-in units before inserting the plug-in units in the receiver base.

b. It is important to have test conditions favorable to good alinement practice. The use of metal-topped bench, or a sheet of metal (preferably cop-

per sheet) under the receiver to be alined, is considered good practice. The test equipment should be bonded to the metal sheet also. The shelter or room where the alinement is performed should be free from stray r-f fields, such as are found in the vicinity of other electronic equipment. If possible, a grounded and screened room should be used. The receiver should be warmed up before the alinement begins. Fifteen minutes of warm-up time is essential, thirty minutes is even better. The receiver power supply (Power Supply PP-846/U) should be fed from a regulated voltage supply delivering 115 volts a-c. All adjustments on the receiver should be performed with non-metallic alinement tools because metal ones may unbalance the various magnetic fields present in electronic circuits, especially in the RF AMPL 152-174 MC plug-in unit. All the alinement points in the receiver are located in the bottom sections of the plug-in units (fig. 69) and are accessible for adjustment when installed in the receiver base.

c. Set the controls on the control unit to the following positions preparatory to alinement:

- (1) VOLUME control to any position clockwise so the POWER lamp is lit.
- (2) SQUELCH control fully clockwise so that the squelch disable switch is in the OFF position.

Note. Any changes in these settings will be given when the procedure demands such changes.

90. I-f Alinement Procedures

a. 455-kc I-f Alinement Procedure. The 455-kc i-f alinement is performed as indicated in the chart below. If the 455-kc i-f stages are far out of alinement it

may be necessary to use a large output from the signal generator to obtain an indication on the VTVM. Use a 455-kc unmodulated signal. As the tuned circuits are alined and the VTVM reading increases appreciably, decrease the signal generator output to prevent overloading. Use the lowest d-c range on the VTVM. If it is not convenient to attach the signal generator to pin 4 of V52, use a junction or tie point that is connected directly to pin 4.

Caution: Alinement of the 455-kc i-f amplifiers must be done before any other alinement is attempted. (This does not apply to the frequency-changing procedure which involves re-alinement of the LOCAL OSC 152-174 MC or the RF AMPL 152-174 MC plug-in units only.)

455-kc i-f alinement chart				
Step	VTVM connection	Signal generator connection	Adjustment	Indication
1	Test points on front of receiver marked DISCR and GND.	Pin 4 of V52 (2d mixer) through a .05-uf paper capacitor. Use approximately 100-uv output.	Discriminator T81 secondary.	+1-v reading on VTVM.
2	Test point at the junction of R101 and C96 (VTVM on lowest negative range).	Pin 4 of V52 (2d mixer) through a paper capacitor. Keep output low to prevent saturation of V86.	Z82.	Maximum output.
3	Test points on front of receiver marked 2ND IF and GND.	Pin of V52 (2d mixer) through a paper capacitor. Keep output low.	Z81 and Z55.	Maximum output.

b. 7.8-mc I-f Alinement Procedure. Before attempting the 7.8-mc i-f alinement procedures be sure the 455-kc i-f stages are alined accurately. Connect the signal generator to pin 4 of V3 through a small mica capacitor and the chassis. Adjust the signal generator to 7.8 mc and check with the frequency standard. After each adjustment, reduce the signal generator output if necessary, to prevent overloading. If this procedure does not produce a maxi-

mum (peak) reading on the VTVM, connect the signal generator to pin 4 of V52 and adjust Z55 for maximum reading. Then connect the signal generator to pin 4 of V51 and adjust Z52, Z53, and Z54 for maximum reading. Then connect the signal generator to pin 4 of V3 and adjust Z54, Z53, Z52, Z51, and Z6 for maximum reading as indicated in the chart below.

7.8-mc alinement chart			
Step	VTVM connection	Adjustments	Indications
1	Test points marked 2ND IF and GND.	Z54, Z53, Z52, Z51 and Z6.	Maximum output.

91. R-f Alinement

a. Test Equipment Connections. The signal generator is connected to plug P1 and ground. A VTVM is used at the 2ND IF and GND test points located at the

front of the receiver. If the r-f alinement needs considerable adjustment, the signal generator output may have to be high. Reduce the signal generator output when necessary in order to keep the VTVM reading on the scale. Proceed as follows:

Step	VTVM connection	Adjustments	Indications
1	Test points on front of receiver marked 2ND IF and GND.	Z1, Z2, Z3, Z4, and Z5.	Maximum negative output.
2	Test points on front of receiver marked 2ND IF and GND.	Repeat step 1 at least 3 times.	Maximum negative output.

b. LOCAL OSC 152-174 MC Alinement.

(1) Aline the LOCAL OSC 152-174 MC plug-in unit, as follows:

Step	VTVM connection	Adjustments	Indications
1	None.	Z31 unscrewed almost all the way counterclockwise.	None.
2	R40 at terminal on TB31 and GND test point.	Z31.	Maximum negative voltage.
3	R34 at terminal on TB31 and GND test point.	Z32 and Z33.	Maximum negative voltage.
4	LO and GND test points.	Z34.	Maximum negative voltage.

(2) *Adjusting receiver to transmitter frequency.* At this point it is possible to adjust the receiver frequency to the transmitter frequency by adjusting the warping coil Z31 which can shift the receiver frequency a few kilo-

cycles in either direction. This feature compensates for slight variations in crystals and alinement. Adjust the warping coil Z31 as follows:

VTVM connection	Signal generator connection	Adjustment
Test points on front of receiver marked DISCR and GND.	No signal generator used. Turn on the transmitter. (Set to the desired frequency.)	Adjust Z31 for a +1-volt reading on the VTVM.

92. Crystal Insertion

a. Removal of Crystal. A crystal oven E31 contains a crystal Y31, a thermostat S31, and a dual heater winding which can be operated from 6.3-volt a-c or d-c or from 24-volt d-c. This oven is disassembled as follows:

(1) Remove the crystal oven E31 from the LOCAL OSC 152-174 MC plug-in unit.

(2) Loosen and remove the three binder head screws from the shell, and then remove the shell.

(3) Lift the heater winding off the oven base.

(4) The crystal and the thermostat can now be removed. Since the crystal and the thermostat are similar in appearance, they can be reversed accidentally. However, the

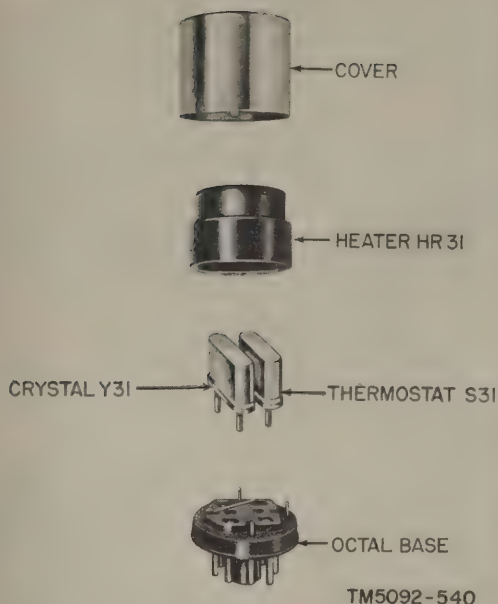


Figure 70. Radio Receiver R-394/U, crystal oven shown disassembled.

crystal has its third overtone frequency marked on it. Figure 70 indicates the method of determining the proper location of each. A decal fastened to the LOCAL OSC 152-174 MC plug-in unit near the octal oven socket will also guide the serviceman in returning the crystal and thermostat to their correct locations.

b. Crystal Selection. The selection of the proper crystal can be made by applying this formula:

$$\text{Crystal frequency} = \frac{\text{Receiver frequency (mc)} - 7.8 \text{ mc.}}{6}$$

c. Reassembling Crystal Oven.

- (1) Plug the crystal and thermostat into the octal oven base.
- (2) Slip the dual heater winding over the crystal and thermostat, observing the location of the contact pins and their proper holes in the octal base.
- (3) Replace the cover and the three binder head screws.
- (4) Plug the crystal oven into the octal socket in the LOCAL OSC plug-in unit.

93. Adjustment of Audio Volume Control

Should the readjustment of the audio volume control, R127, (fig. 69) become necessary proceed as follows:

- (1) Connect Signal Generator SG-3 (or TS-497A/URR), frequency-modulated ± 15 kc with 1,000 cps and tuned to the frequency of the receiver to P1 on the RF AMPL 152-174 MC plug-in unit.
- (2) Connect a VTVM to the front panel test points marked DISCR and GND, and tune the signal generator to the receiver frequency.
- (3) Connect a distortion analyzer to the speaker output terminals (loaded 8 ohms).
- (4) Advance R127 so that output is maximum without exceeding 10-percent harmonic distortion. Audio power should be at least .5 watt.

Section IV. FINAL TESTING

94. General

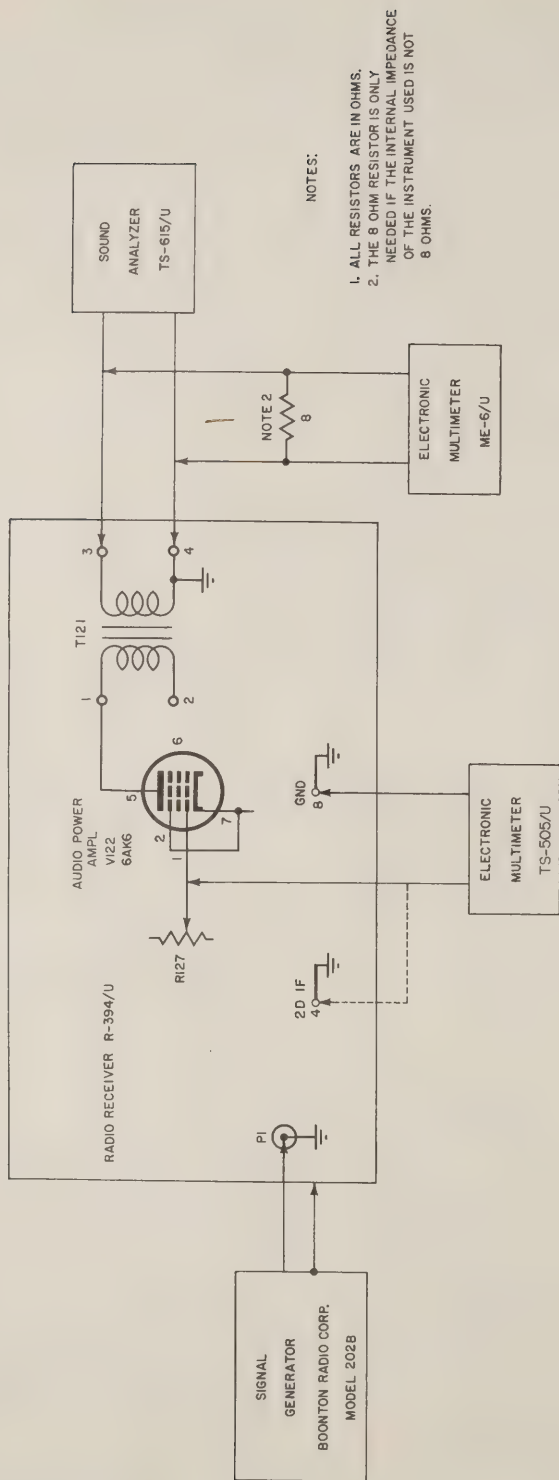
This section is intended as a guide to be used in determining the quality of a repaired Radio Receiver R-394/U. The minimum test requirements outlined in paragraphs 95 through 105 below may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

95. Test Equipment Required for Final Testing

The instruments needed for testing Radio Receiver R-394/U are listed below:

a. Signal Generator. An f-m signal generator capable of producing signals frequency-modulated ± 15 -kc (deviation) with a 1,000-cps audio tone is required for the r-f alinement of the receiver. In addition, the attenuator should be calibrated so that the output voltage can be determined accurately. Signal Generator SG-3 or equivalent (par. 66) is required for this purpose. Also, a signal generator, such as RF Signal Generator Set AN/URM-25 (or Signal Generator TS-588/U), is required for testing the 7.8-mc i-f amplifier and the 455-kc i-f amplifiers and limiters.

b. Output Meter. An output meter such as Output Meter TS-585/U or equivalent is required for meas-



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Figure 71. Final test set-up for Radio Receiver R-394/U.

uring the audio power output of the receiver. The impedance of this meter must match the 8-ohm output impedance of the receiver. An a-c VTVM with an 8-ohm resistor across the output of the receiver can be used for determining power output also.

c. A-c and D-c Vacuum Tube Voltmeters. A d-c VTVM such as Electronic Multimeter TS-505/U, or equivalent, and an a-c VTVM such as Electronic Multimeter ME-6/U, or equivalent, are required for various tests. Electronic voltmeters generally are preferred because of their very high input impedance which practically eliminates circuit loading.

d. Audio Oscillator. An audio oscillator such as Audio Oscillator TS-382/U, or equivalent, is satisfactory for producing audio signals from 20 cps up to 20,000 cps and having a voltage amplitude of at least 10 volts.

e. Distortion Analyzer. A distortion analyzer such as Sound Analyzer TS-615/U, or equivalent, is required for measuring audio distortion accurately at a point of maximum audio output.

96. Standard Test Conditions

a. Final testing will be performed under "standard test conditions." For Radio Receiver R-394/U, these conditions are as follows:

- (1) Audio output shall be .5 watt at the output terminals of the audio output transformer.
- (2) Quieting sensitivity shall be at least 20 db (decibels).
- (3) Signal plus noise-to-noise ratio shall be at least 10 db.
- (4) Input voltage shall be 6.3, 12.6, 26.2 volts d-c or 115 volts or 230 volts at 60 cps, depending on the receiver power supply used.
- (5) Temperature and humidity shall be 59° F to 86° F with 50- to 70-percent relative humidity.
- (6) Warm-up period shall be at least 15 minutes.
- (7) These tests will be modified by the specific test to be used.

b. Controls. Set the controls on the control unit at the following positions unless instructions are otherwise:

- (1) VOLUME control fully clockwise from the OFF position.
- (2) SQUELCH control fully clockwise so that the squelch disable switch is in the OFF position.

- (3) Audio volume control R127 turned fully clockwise for maximum gain.

c. Test Setup. Figure 11 shows a typical set-up of equipment for final test procedure.

- (1) Connect the r-f signal generator to antenna connector P1 on the RF Amplifier 152-174 MC plug-in unit.
- (2) Connect the output meter (8-ohm load) across the secondary of T121. Connect a distortion analyzer to the same points.

d. Units of Measure. When meter scales are not calibrated in db's, power ratios and voltage ratios can be converted into db's by substituting the units in the following formulas:

- (1) $Db = 10 \log \frac{P_2}{P_1}$, where P_1 and P_2 are the two units of power in watts to be compared. For example:

$$\begin{aligned} \text{Let } P_2 &= 50 \text{ watts, and } P_1 = 10 \text{ watts.} \\ \text{Then } db &= 10 \log \frac{P_2}{P_1} = 10 \log \frac{50}{10} \\ &= 10 \times \log 5 = 10 \times .70 = 7.0 \text{ db.} \end{aligned}$$

- (2) $Db = 20 \log \frac{E_2}{E_1}$, where E_1 and E_2 are two voltages (across the same or equal resistances) to be compared. For example:

$$\begin{aligned} \text{Let } E_2 &= 50 \text{ volts and } E_1 = 2 \text{ volts.} \\ \text{Then } db &= 20 \log \frac{E_2}{E_1} = 20 \log \frac{50}{2} \\ &= 20 \times \log 25 = 20 \times 1.40 = 28 \text{ db.} \end{aligned}$$

- (3) When two meter readings are obtained directly in db's, the db gain (or loss) is calculated by subtracting the lower db reading from the higher one.

97. Signal Plus Noise-to-noise Ratio

a. Set the signal generator voltage output to .5 uv (microvolt) frequency-modulated ± 15 kc with 1,000 cps. Note the db indication on the output meter.

b. Turn off the signal generator modulation. Again note the db indication on the power output meter.

c. The difference (subtraction) between the output meter indications described in steps a and b above is the signal plus noise-to-noise ratio. The signal plus noise-to-noise ratio should be at least 10 db with a .5-uv signal, frequency-modulated ± 15 kc at 1,000 cps.

98. Sensitivity

a. The sensitivity of the receiver is measured at the low end, the high end, and the middle of the frequency band. Sensitivity is defined as the signal (number of microvolts) necessary to produce a signal plus noise-to-noise ratio of 10 db.

b. Determine the sensitivity of the receiver by measuring the lowest signal generator input with 1,000-cps ± 15 -kc modulation that will give a 10-db signal plus noise-to-noise ratio. The signal generator input voltage should be no greater than .5 uv.

- (1) Connect the signal generator to antenna connector P1 and apply a .5-uv ± 15 -kc f-m signal with a 1,000-cps tone. Note the output reading on the output meter.
- (2) Turn off the signal generator modulation. The reading on the output meter should be at least 10 db lower than that obtained in subparagraph b(1) above.

99. Power Output and Distortion

a. The power output and distortion test is used for the purpose of determining how much audio power can be developed with a specified percentage of allowable distortion.

b. Use the standard test conditions (par. 96) with the audio volume control R127 turned fully clockwise (maximum gain). Apply a 100-uv (1,000-cps) ± 15 -kc f-m signal to P1 with the signal generator.

c. The power output must be at least .5 watt with the distortion not exceeding 10 percent. If the distortion as indicated on the distortion analyzer exceeds 10 percent, slowly turn R127 counter-clockwise until the distortion is exactly 10 percent. At this point the power output must equal or exceed .5 watt.

100. Over-all Audio Frequency Response

a. The over-all audio frequency response (fig. 72) of the receiver is designed to favor voice communication. A de-emphasis circuit preceding the first audio amplifier attenuates the high-frequency audio signals at the rate of 6 db ± 1 db per octave.

b. Apply a 100-uv f-m signal modulated ± 15 kc with a 1,000-cps audio signal to antenna connector P1. Use this audio output figure as a 0-db reference level and make a frequency response test at audio frequencies between 100 cps and 4,000 cps. The response should agree with the following values within 1 db.

Frequency (cps)	100	300	500	1,000	2,000	2,500	4,000
Response (db)	17.5	10	6	0	-6	-8	-13.2

c. This chart indicates the over-all receiver audio response. The reference point, 0 db, is taken at 1,000 cps.

101. Image Rejection Ratio

a. In Radio Receiver R-394/U, the local oscillator frequency is 7.8 mc lower than the signal frequency to which the r-f amplifiers are tuned. The beating of these two signals in the mixer stage produces an i-f of 7.8 mc. However, a signal 7.8 mc lower than that of the local oscillator (or 15.6 mc lower than that of the desired receiver input signal) will beat also with the local oscillator signal in the mixer stage to produce an i-f of 7.8 mc. The tuned circuits of the r-f amplifiers must reject this image signal. In Radio Receiver R-394/U, this image signal is 15.6 mc (twice the i-f frequency) below the frequency to which the receiver is tuned. For example, if the desired r-f signal is 165 mc, then the undesired image frequency is 165-15.6, which equals 149.4 mc.

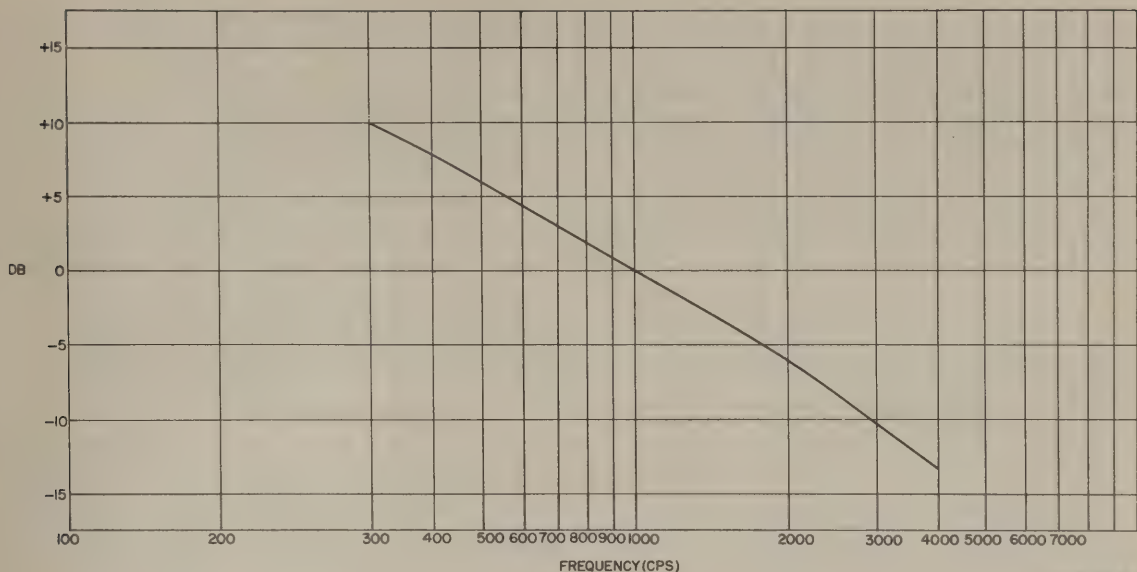
b. With no signal applied to the radio set, note the reading on the output meter caused by noise. Determine the image frequency as outlined in subparagraph a and accurately tune the signal generator to this frequency. Turn on the signal generator and adjust the output for 20-db quieting. Record the output voltage of the signal generator.

c. Repeat the step above except tune the signal generator to the receiver frequency. Record the generator output for this step and compare it with the value obtained in subparagraph b. The ratio of these two input voltages is the image rejection ratio. This image rejection ratio should not be less than 100,000 (100 db). Image rejection ratio

$$= \frac{\text{uv (from c)}}{\text{uv (from b)}}$$

102. I-f Rejection Ratio

a. Signals which reach the antenna and are of the same frequencies as the i-f stages of the receiver may be passed by the receiver and produce interference to normal reception. The two r-f amplifiers in this receiver, V1 and V2, are designed to provide a high rejection ratio of these 7.8-mc and 455-kc signals. The ratio of the input signals at the i-f frequencies and the receiver frequency required to give 20-db quieting is the i-f rejection ratio.



TM 5092-577

Figure 72. Radio Receiver R-394/U, over-all audio frequency response curve.

b. Adjust the signal generator to deliver an unmodulated 455-kc signal to the antenna input to give 20 db quieting. Record this signal generator output.

c. Adjust the signal generator to deliver 7.8 mc to the antenna input to give 20 db quieting. Record this signal generator output.

d. Adjust the signal generator to the receiver frequency and adjust the signal generator output to give 20 db quieting. Record this signal generator output figure.

$$e. 455\text{-kc i-f rejection ratio} = \frac{uv \text{ (from d)}}{uv \text{ (from b)}}$$

$$7.8 \text{ mc i-f rejection ratio} = \frac{uv \text{ (from d)}}{uv \text{ (from c)}}$$

The i-f rejection ratio should be at least 100,000 (100 db).

103. Adjacent and Alternate Channel Selectivity

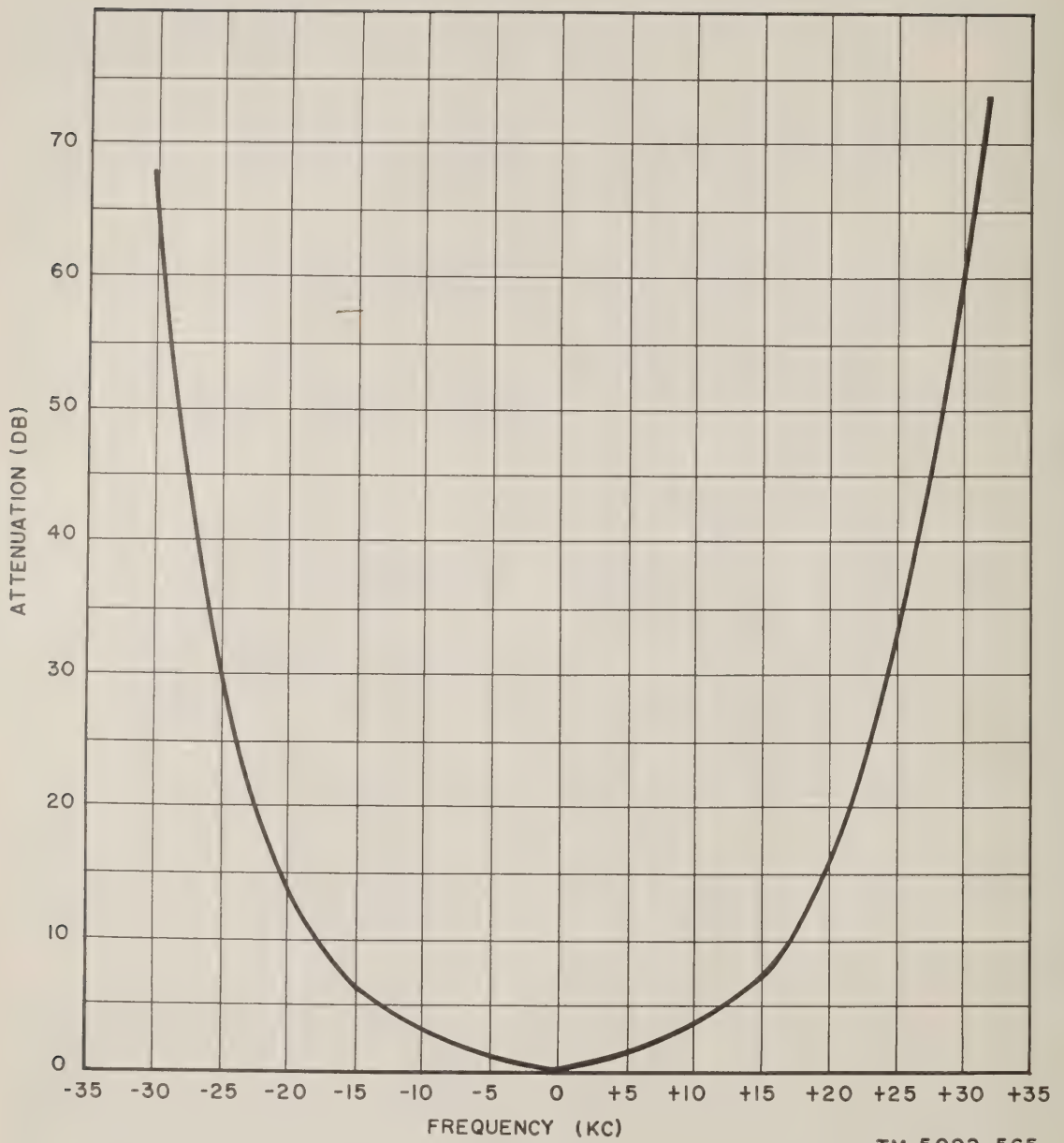
a. Adjacent and alternate channel selectivity is a measure of the receiver's ability to reject signals existing on frequencies 50 kc and 100 kc removed from the receiver frequency. The adjacent channel frequency shall be attenuated at least 80 db below the receiver frequency, and the alternate channel frequency shall be attenuated at least 100 db below the receiver frequency. These tests are accomplished best by comparing the signal injected from a signal generator at the receiver frequency with the signal injected at the adjacent

or alternate channel frequency which will produce the same output from the receiver.

b. Since the output developed from the receiver is a voltage, db units must be interchanged with a voltage ratio; 80 db corresponds to a voltage ratio of 10,000 and 100 db corresponds to a voltage ratio of 100,000.

c. Procedure for determining adjacent and alternate channel selectivity is as follows:

- (1) Connect a d-c VTVM between the test points on the front of the receiver marked 2ND IF and GND. With the signal generator tuned to the receiver frequency with no modulation and zero output observe the VTVM reading resulting from receiver noise.
- (2) Carefully increase the output from the signal generator until the reading on the VTVM begins to rise. Record this reading. Switch the signal generator on and off several times to be sure the increased VTVM reading is the result of the applied signal. Do not set the signal generator output any higher than necessary to obtain the aforementioned indication. Record the output of the signal generator and the reading on the VTVM.
- (3) Shift the signal generator frequency above the receiver frequency 50 kc and increase the signal generator output so that the



TM 5092-565

Figure 73. Over-all selectivity curve of Radio Receiver R-394/U.

VTVM reading from step (2) is duplicated. Repeat the same operation at a frequency 50 kc below the receiver frequency. The signal generator output required for duplicating the VTVM reading from step (2) should be similar for adjacent channel frequencies (50 kc) above and below the receiver frequency and attenuated at least 80 db, a voltage ratio of 10,000 to 1.

- (4) Repeat step (3) except tune the signal generator to alternate channel frequencies (100 kc) above and below the receiver frequency. The alternate channel selectivity should be at least 100 db, a voltage ratio of 100,000 to 1.

104. Squelch Tests

a. This test is designed to determine whether the squelch circuit sensitivity is adequate. The test measures the ratio between the receiver noise with the squelch circuit disabled and no signal input as against the receiver noise resulting from the minimum signal required to squelch the receiver when the squelch control is set in a position of maximum sensitivity.

b. Procedure for testing the squelch circuit:

- (1) Tune the signal generator to the receiver frequency with no modulation and zero output.
- (2) Connect a d-c VTVM to pin 4 of audio output tube V122.
- (3) Connect the output meter across terminals 3 and 4 of audio output transformer T121.
- (4) With the SQUELCH control at OFF (maximum clockwise position) and zero output from the signal generator read the output meter and record this reading.
- (5) Turn the SQUELCH control counterclockwise slowly and stop at the point where the audio circuits become squelched, as indicated by a reading of approximately -25 volts on the VTVM.
- (6) Advance the output of the signal generator slowly until the VTVM reading drops to almost zero. The receiver is again unsquelched. Take a reading on the output meter.
- (7) Determine the squelch sensitivity as follows: Squelch sensitivity (db) = $\frac{\text{value from step (4) (db)}}{\text{value from step (6) (db)}}$. The squelch sensitivity should be less than 10 db.

105. Over-all Receiver Selectivity

a. General. The overall selectivity of the receiver is a measure of the passband characteristics from the antenna connector P1 to the output terminals. Since the audio stages have a fixed response, output measurements from this test are taken at the grid of the fifth 455-kc i-f amplifier. This test compares the receiver gain at resonance and at points off resonance.

b. Procedure for Determining Receiver Selectivity.

- (1) Connect a d-c VTVM between the front test points of the receiver marked 2ND IF and GND. With the signal generator tuned to the receiver frequency with no modulation and zero output, observe the VTVM reading resulting from receiver noise.
- (2) Carefully increase the output from the signal generator until the reading on the VTVM begins to rise. Record this reading. Switch the signal generator on and off several times to be sure the increased VTVM reading is the result of the applied signal. Do not set the signal generator output any higher than necessary to obtain the aforementioned indication. Record the output of the signal generator and the reading on the VTVM.
- (3) Shift the signal generator frequency above the receiver frequency 15 kc and increase the signal generator output so that the VTVM reading in step (2) will be duplicated. Repeat the same operation at a frequency 15 kc below the receiver frequency. The signal generator output for frequencies above the receiver frequency should be similar to the output below the receiver frequency and twice the signal generator output recorded from step (2) (6 db).
- (4) Repeat step (3) except shift to frequencies 35 kc above and below the receiver frequency. The ratio between the signal generator output required for this step and step (2) should be approximately 100,000 (100 db). Figure 73 shows a typical over-all frequency response curve of a properly functioning receiver.

106. Discriminator Test

a. General. The discriminator test gives an indication of proper discriminator operating conditions as shown graphically in figure 30. The input signal to this stage is varied above and below the second i-f of 455 kc and the d-c output of the discriminator is measured.

b. Procedure for Discriminator Test.

- (1) Connect a d-c VTVM between ground and the junction of C96 and R101, the test point from the grid of the second limiter V87. Tune the i-f signal generator to 455 kc, without modulation, and feed the output through a small mica capacitor (approximately 1000 uuf) to the control grid of the second mixer V52 and ground. Adjust the output of the signal generator to give an approximate VTVM reading of -25 volts. Move the VTVM to the front panel test points marked DISCR and GND. The discriminator output should be +1 volt when properly aligned.
- (2) Carefully tune the signal generator below 455 kc to that frequency which gives a maximum negative indication on the VTVM. Carefully tune back and forth through this point to be sure the setting of the signal generator gives the maximum VTVM indication. Record this reading. Do the same for the frequency above 455 kc which gives a maximum positive indication on the VTVM. The points of maximum positive and negative indications must be at least 35 kc removed from 455 kc (420 and 490) kc).
- (3) Tune the signal generator to 440 kc and record the VTVM reading. Both readings should be a minimum of 7 volts removed from the original +1 volt reading (+8 volts and -6 volts). The change in discriminator output voltage produced by the 440-kc signal must not differ from that produced by the 470-kc signal by more than 3 volts.
- (4) Tune the signal generator to 420 kc and 490 kc, and record the discriminator output voltages (as in subpar. (2) above). The readings of both polarities on the VTVM should be a minimum of 14 volts removed from the original +1 volt reading (+15 volts and -13 volts). The change in discriminator output voltage produced by the 420-kc signal must not differ from that produced by the 490-kc signal by more than 6 volts.
- (5) If the minimum requirements of steps (2), (3), and (4) are not obtained, the discriminator stage requires realignment, repair, or replacement.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

107. Repacking for Shipment or Limited Storage

a. The exact procedure used in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 12 and reverse the unpacking instructions as far as practicable.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the case or carton which contains the receiver. Protect it with a waterproof paper barrier. Seal the seams with sealing compound or tape. Provide at least 3 inches of excelsior padding between the paper barrier and packing case.

108. Demolition of Materiel to Prevent Enemy Use

The demolition procedures outlined in paragraph 108 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only on order of the commander.

109. Methods of Destruction

a. *Smash.* Smash the crystals, controls, tubes, coils, switches, capacitors, and transformers, using sledges, axes, handaxes, hammers, crow-bars, or other heavy tools.

b. *Cut.* Cut cords and wiring, using axes, handaxes, or machetes.

c. *Burn.* Burn cords, resistors, capacitors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. *Bend.* Bend panels, cabinet, and chassis.

e. *Explosives.* If explosives are necessary, use fire-arms, grenades, or TNT.

f. *Disposal.* Burn or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. *Destroy.* Destroy everything.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR-310-20-3, SR-310-20-4, and SR-310-20-5. Check Department of the Army Supply Catalog SIG 1 for Signal Corps Supply Catalog pamphlets.

1. Army Regulations

- AR 380-5 Military Security (Safeguarding Military Information).
- AR 750-5 Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Bulletins

- SB 11-6 Dry Battery Supply Data.
- SB 11-47 Preparation and Submission of Requisitions for Signal Corps Supplies.
- SB 11-76 Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Auxiliary Equipment and Test Equipment

- NAVSHIPS 91,269 Electronic Multimeter ME-6A/U.
- NAVSHIPS 91,272 Oscilloscope OS-8A/U.
- NAVSHIPS 91,274 Tube Tester TV-3/U.
- NAVSHIPS 91,283 RF Signal Generator Set AN/URM-25.
- TM 11-300 Frequency Meter Sets SCR-211-A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL.
- TM 11-303 Test Sets I-56-C, I-56-D, I-56-H, and I-56-J.
- TM 11-321 Technical Manual for Test Set I-56-E.
- TM 11-472 Repair and Calibration of electrical Measuring Instruments.
- TM 11-1257 Signal Generator AN/URM-48.
- TM 11-1258 Signal Generator SG-3 (not yet available).
- TM 11-2524 Oscillators I-151-A and I-151-E.
- TM 11-2526 Oscilloscope BC-1060-A.
- TM 11-2613 Volt ohmmeter I-166.
- TM 11-2624B Volt ohmmeters TS-294/U, TS-294B/U, and TS-294C/U.

- TM 11-2626 Test Unit I-176, I-176-A, and I-176-B.
- TM 11-2627 Tube Tester I-177 and I-177-A.
- TM 11-2684A Audio Oscillator TS-382A/U.
- TM 11-4700 Electrical Indicating and Measuring Instruments, Repair Instructions.
- TM 11-5017 Output Meter TS-585A/U or TS-585B/U.
- TM 11-5018 Signal Generator TS-588/U.
- TM 11-5032 Sound Analyzer TS-615/U.
- TM 11-5043 Analyzer ZM-3/U.
- TM 11-5044 Frequency Standard TS-174B/U.
- TM 11-5511 Electronic Multimeter TS-505/U.
- TM 11-5527 Multimeter TS-352/U.

4. Painting, Preserving, and Lubrication

- TB SIG 13 Moistureproofing and Fungiproofing Signal Corps Equipment.
- TB SIG 69 Lubrication of Ground Signal Equipment.
- TM 9-2851 Painting Instructions for Field Use.

5. Camouflage, Decontamination, and Demolition

- FM 5-20 Camouflage, Basic Principles
- FM 5-25 Explosives and Demolitions.
- TM 3-220 Decontamination.
- TM 5-267 Camouflage.

6. Other Publications

- FM 24-18 Field Radio Techniques.
- FM 72-20 Jungle Warfare.
- SR-310-20-3 Index of Training Publications
- SR 310-20-4 Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Table of Organization, and Tables of Equipment.

SR 310-20-5	Index of Administrative Publications.	TB SIG 219	Operation of Signal Equipment at Low Temperatures.
SR 700-45-5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD-247).	TB SIG 223	Field Expedients for Wire and Radio.
SR 745-45-5)	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD-66 (Army), SandA-70-6 (Navy), and AF-MC-U2 (Air Force)).	TM 9-2857	Storage Batteries Lead-Acid Type.
NAV DEPT)		TM 11-314	Antennas and Antenna Systems.
SERIAL 85P00)		TM 11-415	Dry Batteries.
AFR 71-4)		TM 11-430	Batteries for Signal Communication. Except those pertaining to Aircraft.
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.	TM 11-453	Shop Work.
TB SIG 25	Preventive Maintenance of Power Cords.	TM 11-455	Radio Fundamentals.
TB SIG 54	Working through Jamming with Frequency Modulated Radio Sets.	TM 11-466	Radar Electronic Fundamentals.
TB SIG 66	Winter Maintenance of Signal Equipment.	TM 11-476	Radio Direction Finding.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.	TM 11-483	Suppression of Radio Noises.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.	TM 11-496	Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.	TM 11-661	Electrical Fundamentals (Direct Current).
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.	TM 11-662	Theory and Application of Electron Tubes.
		TM 11-681	Electrical Fundamentals (Alternating Current).
		TM 11-4000	Trouble Shooting and Repair of Radio Equipment.

GLOSSARY

ABBREVIATIONS

A-c alternating-current
 Adj, ADJ. adjustment, adjust
 a-f. audio-frequency
 agc automatic gain control
 a-m amplitude-modulated
 amp, A ampere
 AMPL amplifier
 ANT. antenna
 avc, AVC automatic volume control
 CCW counterclockwise
 cps cycles per second
 CW clockwise
 c-w continuous-wave
 db decibel
 d-c direct-current
 DOUB. doubler
 f-m frequency-modulated
 gnd ground
 h-f. high-frequency
 h-v high-voltage
 i-f. intermediate-frequency
 INT intermediate

kc kilocycle
 ma. milliamperes
 max. maximum
 mc. megacycle
 meg, MEG. megohm
 MIC microphone
 OSC oscillator
 PA. power amplifier
 REC. receiver
 r-f. radio-frequency
 rms. root mean square
 term terminal
 uf, UF microfarad
 uuf, UUF. micromicrofarad
 v, V volt
 vhf. very high frequency
 VOL. volume
 VTVM vacuum-tube voltmeter
 w, W watt
 XMTR transmitter
 XTAL. crystal

APPENDIX II

IDENTIFICATION TABLE OF PARTS

1. Requisitioning Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O & E, T/A, SIG 7 & 8, list of allowances of expendable material, or other authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this instruction book is SIG 7&8-R-394/U. For an index of available supply catalogs, see the latest issue of SIG 1.

2. Identification Table of Parts

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	AN RADIO RECEIVER R-394/U: F3 reception; 152 to 174 mc range d-c power requirements 155 v, .015 amp; 150 v, .005 amp; 140 v, .060 amp; -40 v, .5 amp; 24 v, .25 amp; 6 v, .9 amp; 6 v, .45 amp; 1.4 v, 1.2 amp; mounts in standard case; 14-1/2 in. lg x 5-3/4 in. wd x 8-1/2 in. h o/a.	Radio Receiver for Radio Sets AN/FRR-36, AN/FRC-27, AN/VRC 19 (*), AN/TRC-28.	2C4180-394
	RECEIVER, radio: F3 reception; 1 band, 152 to 174 mc range; dc power requirements; 155 v, .015 amp; 150 v, .005 amp; 140 v, .060 amp; -40 v, .5 amp; 24 v, .25 amp; 6 v, .9 amp; 6 v, .45 amp; 1.4 v, 1.2 amp; mts in standard case; 14-1/2 in. lg x 5-1/4 in. wd x 8-1/2 in. h; electron tubes; superheterodyne ckt; c/o 5 plug-in-units: 1 rf plug-in-unit, Motorola Inc. part #201V1075; 1st IF plug-in-unit, Motorola Inc. part #201V1065; Oscillator Plug-In Unit, Motorola Inc. Part #201V1078; 2nd IF plug-in-unit, Motorola Inc. Part #201V1068; Audio Plug-In Unit, Motorola Inc. Part #201V1096; Receiver Base, Motorola Inc. Part #201V1096; Motorola Inc. Part #201V1098; For Communications.	Radio Receiver for Radio Set AN/VRC-19X, 19V, 19Z & AN/FRR-36.	
E37	ADAPTER, crystal socket: fits 1/2 in. pin-spaced crystal holder to octal socket; plaskon, nickel pl brass cont; round shape; 1.250 in. dia, .937 in. thk o/a; plugs into octal socket; marked "X" and "T" for coding purposes; 3 male pin term., 1 spring wire term., and 4 female term.	Crystal oven adapter.	
A 1, A 2	BRACKET: supports tube shield; "L" shape; brass, silver pl 1-1/4 in. lg x 13/32 in. wd x 5/16 in. h o/a; mts by one .125 in. dia hole; has hook for holding tube shield.	Hold tube shield in place.	2Z1244-326
E23, E73, E90	CAP, brass: silver pl; 3/8 in. dia, 3/32 in. thk; protective cover for coaxial angle hood.	Caps for coaxial connector angle hood.	2Z1607-124

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C1, C67	CAPACITOR, fixed: ceramic dielectric; 5 uuf .25 uuf; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	C1: Part of Z1 network. C67: Part of Z55 network.	3D9005-113
C2, C87, C94	CAPACITOR, fixed: ceramic dielectric; 39 uuf +5%; 500 vdcw; 470 uuf per uf per deg C negative, +60 uuf tolerance.	C2: Part of Z1 network. C87: Part of Z81 network. C94: Part of Z82 network.	3D9036-23
C3,	CAPACITOR, fixed: ceramic dielectric; 5 uuf .25 uuf; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	C3: V1 control grid coupling.	3D9005-146
C4, C7	CAPACITOR, fixed: ceramic dielectric; 10 uuf .25 uuf; 500 vdcw; 220 uuf per uf per deg C negative, +60 uuf tolerance.	C4: Part of Z2 network. C7: Part of Z4 network.	3D9010-225
C5, C8	CAPACITOR, fixed: ceramic dielectric; 6 uuf .25 uuf; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	C5: Part of Z3 network. C8: Part of Z5 network.	3D9006-46
C6, C9	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA Ref Dwg Group 1; 8 uuf +0.25 uuf; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	C6: Part of Z3 network. C9: Part of Z5 network.	3D9008-51
C10, C51	CAPACITOR, fixed: ceramic dielectric; case style No. 1 MBCA Ref Dwg Group; 5 uuf +.25 uuf; 500 vdcw; uuf per uf per deg C negative, +60 uuf tolerance.	C10: Part of Z6 network. C51: Part of Z51 network.	3D9005-131
C11, C52	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA Ref Dwg Group 1; 100 uuf +20%; 600 vdcw; variable.	C11: Hash filter for Z6. C52: Part of Z51 network.	3D9100-311
C12 thru C18, C28	CAPACITOR, fixed: ceramic dielectric; case style No. 7, MBCA Ref Dwg Group 1; 1000 uuf -0 to +100%; 500 vdcw.	R-f bypass filters.	3DA1-369
C36, C37, C71	CAPACITOR, fixed: ceramic dielectric; 5000 uuf +100 -0%; 500 vdcw.	C36: V32 control grid bypass. C37: V32 screen grid bypass. C71: B+ bypass.	3DA5-246
C19, C22, C24, C25, C26	CAPACITOR, fixed: ceramic dielectric; 2000 uuf +100% -0%; 500 vdcw.	C19: V3 screen grid bypass. C22: V3 filament bypass. C24: V1 screen grid bypass. C25: V2 screen grid bypass. C26: V3 cathode bypass.	

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C23, C57, C59, C61, C77	CAPACITOR, fixed: ceramic dielectric; case style No. 1 MBCA Ref Dwg Group 1; 24 uuf +5%; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	C23: Part of Z6 network. C57: Part of Z52 network. C59: Part of Z53 network. C61: Part of Z54 network. C77: Part of Z51 network.	3D9024-63
C27	CAPACITOR, fixed: ceramic dielectric; case style No. 1 MBCA Ref Dwg Group 1 capacitance data 12 uuf capacity +5% tolerance 500v DC working temp coefficient data 150 uuf per uf per deg C negative +60 uuf tolerance.	Part of Z6 network.	3D9012-87
C31	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA Ref Dwg Group 1; 10 uuf +0.25 uuf; 500 vdcw; 150 uuf per uf per deg C negative, +60 uuf tolerance.	V31 control grid bypass.	3D9010-224
C32, C35, C40, C55, C70, C75	CAPACITOR, fixed: ceramic dielectric; 2 sect., 5000 uuf +100 -0%; 500 vdcw, ea sect.	C32 V31 screen grid bypass. C35: V32 screen grid and cathode bypass. C40: V33 screen grid and cathode bypass. C55: V51 screen grid bypass. C70: L56 and L57 bypass. C75: B+ bypass.	3DA5-258
C34, C39, C42	CAPACITOR, fixed: ceramic dielectric; 33 uuf +1.65 uuf; 500 vdcw; 150 uuf per uf per deg C, +60 uuf tolerance.	C34: Oscillator tripler coupling capacitor. C39: Tripler doubler coupling capacitor. C42: Doubler output coupling capacitor.	3D9033-56
C21, C38, C60	CAPACITOR, fixed: ceramic dielectric; case style No. 2, MBCA ref dwg group 1; 0.15 uuf -.01 uuf, +.03 uuf.	C21: V2, V3 coupling. C38: Coupling between plate of V32 and network Z33. C60: Z53, Z54 coupling.	3D9000.15-1
C43, C81A, C81B, C89A, C89B, C101	CAPACITOR, fixed: ceramic dielectric; 2 sect., ea 10,000 uuf +100 -0% ea sect. 500 vdcw, ea sect.	C43: E31 oven heater bypass. C81A: 1st IF test point bypass. C81B: V81 and V82 screen grid bypass. C89A: V84 and V85 screen grid bypass. C89B: B+ bypass. C101: B+ bypass.	3DA10-624

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C44, C45	CAPACITOR, fixed: ceramic dielectric; 1500 uuf +50 -20%; 500 vdcw.	C44: Rf bypass on V31, V32, and V33 B+. C45: V31 filament by-pass.	3DA1.500-69
C53, C78, C79, C80	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; capacitance 12 uuf $\pm 5\%$; 500 vdcw; -0 +60 uuf per uf per deg C.	C53: Part of Z51 network. C78: Part of Z52 network. C79: Part of Z53 network. C80: Part of Z54 network.	3D9012-86
C54	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 5 uuf ± 25 uuf; 500 vdcw; 0 uuf per uf per deg C negative, ± 60 uuf tolerance.	Z51-V51 Control grid coupling.	3D9005-145
C20, C58	CAPACITOR, fixed: ceramic dielectric; case style No. 2, MBCA ref dwg group 1; .35 uuf ± 05 uuf tolerance.	C20: V1, V2 coupling. C58: V51 output to Z53 coupling.	3D9000.35
C62	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 12 uuf $\pm 5\%$; 500 vdcw; 0 uuf per uf per deg C negative, ± 60 uuf tolerance.	V51 to V52 coupling.	3D9012-90
C65	CAPACITOR, fixed: Ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 8 uuf ± 25 uuf; 500 vdcw; 150 uuf per uf per deg C negative, ± 60 uuf tolerance.	Part of Z55 network.	3D9008-51
C66	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 15 uuf $\pm 2\%$; 500 vdcw; 150 uuf per uf per deg C negative, ± 60 uuf tolerance.	Part of Z55 network.	3D9015-160
C68	CAPACITOR, fixed: ceramic dielectric; 10,000 uuf -20% +80%; 150 vdcw.	RF test point bypass.	3DA10-594
C73	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 36 uuf $\pm 5\%$; 500 vdcw; 0 uuf per uf per deg C negative, ± 60 uuf tolerance.	Plate-to-grid feedback.	3D9036-24
C76	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; .75 uuf ± 0.25 uuf; 500 vdcw; 30 uuf per uf per deg C negative, ± 250 uuf tolerance.	V52 Control grid coupling from second h-f oscillator.	3D9000.75-6
C82, C90	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 47 uuf $\pm 5\%$; 500 vdcw; 330 uuf per uf per deg C negative, ± 500 uuf tolerance.	C82: V81-V82 coupling. C90: V84 to V85 coupling.	3D9047-78
C84, C88, C91, C95	CAPACITOR, fixed: ceramic dielectric; case style No. 1, MBCA ref dwg group 1; 24 uuf $\pm 5\%$; 500 vdcw; 150 uuf per uf per deg C negative, ± 60 uuf tolerance.	C84: V82-V83 coupling. C88: V83-V84 coupling. C91: V85-V86 coupling. C95: V86-V87 coupling.	3D9024-67

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C93, C100, C102	CAPACITOR, fixed: ceramic dielectric; case style see dwg at end of description 10,000 uuf +100 -0%; 500 vdcw.	C93: V86 screen grid bypass. C100: CR81 DISCR test point bypass. C102: V87 screen grid bypass.	3DA10-562
C124	CAPACITOR, fixed: mica dielectric; case style No. 22, MBCA ref dwg group 1; 200 uuf $\pm 5\%$; 500 vdcw; -100 to +100 parts per million per deg C temp coefficient; molded bakelite.	V121 plate-grid inverse feedback.	3D9200-106
C127	CAPACITOR, fixed: mica dielectric; case style No. 22, MBCA ref dwg group 1; 100 uuf $\pm 5\%$; 500 vdcw; -100 to +100 parts per million per deg C temp coefficient.	Noise input coupling.	3D9100-302
C128	CAPACITOR, fixed: mica dielectric; case style No. 22 MBCA ref dwg group 1; 47 uuf $\pm 5\%$; 500 vdcw; -200 to +200 parts per million per deg C temp coefficient.	V123 control grid coupling.	3D9047-76
C129	CAPACITOR, fixed: mica dielectric; case style No. 22, MBCA ref dwg group 1; 24 uuf $\pm 5\%$; 500 vdcw; -200 to +200 parts per million per deg C temp coefficient.	V123 control grid coupling.	3D9024-64
C83, C86	CAPACITOR, fixed: paper dielectric 1 sect. case style No. 2, MBCA ref dwg group 1; 22000 uuf $\pm 20\%$; 200 vdcw; not designed for radio frequency application.	C83: B+ plate bypass for V81 and V82. C86: B+ plate bypass for V81, V82, V83	3DA22-27
C121	CAPACITOR, fixed: paper dielectric; 1 sect.; case style No. 2, MBCA ref dwg group 1; 1000 uuf $\pm 20\%$; 200 vdcw.	R-f bypass capacitor for V121 grid circuit.	3DA1-368
C122, C126	CAPACITOR, fixed: paper dielectric; 1 sect.; case style No. 2, MBCA ref dwg group 1; 10,000 uuf $\pm 20\%$; 200 vdcw.	C122: V121 audio input coupling. C126: V122 audio input coupling.	3DA10-622
C123	CAPACITOR, fixed: paper dielectric; 1 sect.; case style No. 2, MBCA ref dwg group 1; 47,000 uuf $\pm 20\%$; 100 vdcw; not AC rated.	V121 grid a-c return.	3DA47-28
C130	CAPACITOR, fixed: paper dielectric; 22,000 uuf $\pm 20\%$; 100 vdcw; hs metal can.	V123 plate feedback filter.	
C131, C133	CAPACITOR, fixed: paper dielectric; 1 sect. case style No. 2, MBCA ref dwg group 1; 2200 uuf $\pm 20\%$; 200 vdcw.	C131: Couples plate of V123 to CR121. C133: High frequency a-f bypass.	3DA2.200-31
C252	CAPACITOR, fixed: paper dielectric; 22,000 uuf $\pm 20\%$; 100 vdcw; sealed tubular metal case.	AGC bypass.	
L2, L6, L38, L40 L41	CHOKE, RF: no current rating; plate lead r-f choke for V1; for use with frequencies 152 meg to 172 meg; cylindrical shape; Motorola, Inc. Part No. 224B1009.	L2: V1 plate r-f choke. L6: V2 plate r-f choke. L38: V33 plate r-f choke. L40: Crystal heater choke.	3C1084B-92

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
L5, L10, L14, L34	COIL, RF: 100 ma current rating; filament lead r-f choke; designed for use at 7.9 mc; Motorola Inc. Part No. 224B1010.	L41: Crystal heater choke. L5, L14: V2 filament chokes. L10: V3 filament choke. L34: V32 filament choke.	3C1084B-93
L9	CHOKE, RF: no current rating; filament r-f choke; for use w/freq above 150 mc; cylindrical shape; Motorola, Inc. Part No. 224B1008.	Matches output of 1st h-f oscillator to mixer V3 grid.	3C1084B-91
L32, L37	COIL, RF: 100 ma current rating; filament lead radio frequency choke; for use at 7.9 mc; cylindrical shape; Motorola, Inc. Part No. 224B1025.	L32: V31 filament choke. L37: V33 filament choke.	
L33	COIL, RF: 160 ma current rating; oscillator plate radio frequency choke; for use at 7.9 mc; cylindrical shape; Motorola Inc. Part No. 224B1024.	V31 plate choke.	3C1084B-94
L121	COIL, RF: 250 ma current rating; Motorola Inc. Part No. 224B1037.	V121 filament choke.	3C1084B-96
H257, H258	CLAMP, electrical: ethyl cellulose acetate; no protective finish; no fastening device; 1 in. lg approx x 1/2 in. wd x 7/16 in. h o/a; one mtg hole for #8 screw in ea end of clamp; accom material up to 3/16 in. dia.	Cable clamps.	8P1-101-2
H263, H264	CLAMP, electrical: ethyl cellulose acetate; no protective finish; no fastening device; 13/16 in. lg x 1/2 in. wd x 5/16 in. h o/a; one mtg hole for 8-32 screw base of clamp; accom material up to 1/4 in. max dia.	Cable clamps.	8P1-101-1
H265, H266	CLAMP, electrical: ethyl cellulose acetate; natural finish; no fastening device data; 61/64 in. wd x 61/64 in. lg x 1/2 in. wd x 1/2 in. h o/a; mtd by 1 mtg hole .204 in. dia in base of clamp; designed to hold material 3/8 in. max dia.	Used as cable clamps.	2Z2642.434
E10, E11, E12, E63, E64, E84	CLIP, electrical: beryllium copper; silver pl finish; 11/32 in. dia, 7/32 in. d.	E10: Hold coaxial cable in place. E11, E12, E63, E64, and E84: Retain male connector.	2Z2712.380
H52	CLIP, electrical: phosphor bronze; 55/64 in. lg x 3/8 in. wd x 7/16 in. h.	Holds crystal in place.	2Z2712.379
L42	COIL, RF: 1.6 uh at 1 mc; .8 ohms dc resistance; 100 ma; tuning not adjustable.	Filament choke for V31, V32, and V33.	3C362-99

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
L56	COIL, RF: 6.5 uh at 7.9 mc; .06 ohms dc resistance; 500 ma; tuning not provided.	V51 filament choke.	3C362-100
L57, L58	COIL, RF: 25 uh at 2.5 mc; 1.75 ohms dc resistance.	L57: V51 filament choke. L58: V53 plate supply r-f choke.	
Z1	COIL ASSEMBLY, RF: .2 uh at 1 mc; .01 ohms dc resistance; 2 amp; adjustable tuning; adjustable conductive core; key adjustment located on bottom.	Antenna tuning.	3Z1084B-72
Z2, Z4	COIL ASSEMBLY, RF: .25 uh at 1 mc; .012 ohms dc resistance; 2 amp; adjustable tuning; adjustable iron core; key adjustment located on bottom.	Z2: V1 plate tuning. Z4: V2 plate tuning.	3C1084B-71
Z3, Z5	COIL, RF: .25 uh at 1 mc; .012 ohms dc resistance; 2 amp; adjustable tuning; adjustable iron core; key adjustment located on bottom.	Z3: V2 grid tuning. Z5: V3 grid tuning.	3Z1084B-73
Z6	COIL, RF: 5.6 uh at 7.9 mc; .32 ohm dc resistance; 200 ma; adjustable tuning; adjustable iron core; key adjustment located on bottom.	Tuned circuit for output of V3 to match line impedance.	3C1084B-75
Z31	COIL, RF: 6.4 uh at 7.9 mc; .60 ohm dc resistance; 80 ma; adjustable tuning; adjustable iron core; key adjustment located on bottom.	Oscillator tuning coil.	3C1084B-76
Z32, Z33	COIL, RF: .4 uh at 25 mc; .025 ohms dc resistance; 500 ma; adjustable tuning; adjustable iron core; tool adjustment through bottom of mounting base.	Z32: V32 plate tuning. Z33: V33 grid tuning.	3C1084B-74
Z34	COIL, RF: 8-1/2 turns copper strip .0625 in. wd x .012 in. thk; adjustable tuning; adjustable conductive core; screw driver adjustment located on bottom.	V33 output matching coil.	3C1084B-77
Z51	COIL, RF: 5.6 uh at 7.9 mc; .32 ohm dc resistance; 200 ma; adjustable tuning; adjustable iron core; key adjustment located on bottom.	V51 grid tuning.	3C1084B-66
Z52, Z53, Z54	COIL, RF: 5.6 uh at 7.9 mc; .32 ohms dc resistance; 200 ma; adjustable tuning; adjustable iron core; key adjustment through bottom of coil.	Z52: V51 plate tuning. Z53: I-f selectivity filter. Z54: I-f selectivity filter.	3C1084B-68
Z55	COIL, RF: 5 uh at 250 kc; 45 ohms dc resistance; 30 ma; adjustable tuning; adjustable iron core; key adjustment located on bottom.	V52 to V81 coupling.	3C1084B-70
Z81	COIL, RF: 1.20 uh at 250 kc; 30 ohms dc resistance; 30 ma; adjustable tuning; adjustable iron core; key adjustment located on bottom.	V83 plate load.	3C1084B-69
Z82	COIL, RF: 1.2 uh at 250 kc; 28 ohms dc resistance; 30 ma; adjustable tuning; adjustable iron core; wrench adjustment on base.	V86 plate load.	3C1084B-67

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
P2, P32, P51, P82	CONNECTOR, receptacle: 14 male rd cont; not polarized; straight type.	P2: Connects r-f unit to base. P32: Input connector, oscillator unit. P51: Connects first i-f unit to J257. P82: Connects second i-f to base.	2Z3034-54
J251, J253 thru J255, J258, J259, J261	CONNECTOR, receptacle: one male rd cont; straight type; 50 ohms nominal impedance; Motorola, Inc. Part No. 228B1010.	Male coaxial connectors.	2Z3021-304
J252, J256, J257, J260, J263	CONNECTOR, receptacle: 14 female rd cont; not polarized; straight type.	J252: Connects r-f unit to base. J256: Connects local oscillator unit to base. J257: Connects first i-f unit to base. J260: Connects second i-f unit to base. J263: Connects select call unit to base.	2Z3075-46
J262	CONNECTOR, receptacle: 18 female rd cont; not polarized; straight type; not angle type.	Connects audio plug-in unit plug to base.	2Z3079-13
P121	CONNECTOR, plug: 18 male rd cont; polarized; straight type.	Audio plug-in receptacle.	2Z3038-11
P252	CONNECTOR, receptacle: 31 male rd cont; polarized; straight type; 2 cont rated at 40 amp and 28 cont rated at 10 amp; Body data; rectangular aluminum alloy molded phenolic insert no cable opening; has one coax connector included in cont.	Connects receiver base to case CX-938()/U.	2Z3046-38
TB253, TB254	CONNECTOR, receptacle: 4 female rd cont; not polarized; straight type; rectangular body, phenolic. Polyamide insulator at the front of each contact.	Voltage check points.	2Z3065-127
H5, H32 thru H35, H53 thru H55, H90 thru H96, H126 thru H129	CLIP, electrical: steel and brass; spring, passivated; support, cad pl and olive drab iridite; 1-11/32 in. lg 5/8 in. wd o/a, 5/32 in. thk across flats; not insulated.	Hold tubes in place.	2Z2712.381

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
CR81, CR82, CR121	CRYSTAL UNIT, rectifying: germanium type; .035 amp max continuous forward current, .100 amp max peak forward current; 80 v peak inverse voltage; 1 uuf shunt capacitance; 25/64 in. lg, 9/64 in. dia excluding term; term. mtd; 500 ma max transient surge current Raytheon Mfg Co. Type No. CK707.	CR81, CR82: Discriminator rectifiers. CR121: Rectifier and voltage regulator for V123 grid bias voltage.	2JIN63
Y51	CRYSTAL UNIT CR-18/U, quarts: single crystal plate; 7345 kc nominal freq; crystal holder No. HC-6/U; rect shape, phosphor bronze; .345 in. dia, .758 in. lg, .750 in. h; marked CR18/U and freq 7345 kc; hermetically sealed; $\pm .005\%$ of nominal freq when measured over the temprange of -55° to $+90^{\circ}$ C.	V53 oscillator crystal.	2X209-7345
V1	ELECTRON TUBE: pentode; glass envelope; 8 terminations; wire type, located on bottom; special purpose subminiature r-f pentode; type 5840.	First r-f amplifier.	2J5840
V2, V3, V31, V33	ELECTRON TUBE: pentode; glass envelope; 5 terminations, wire type, located on bottom; subminiature r-f pentode; type 1AD4.	V2: 2d r-f amplifier. V3: 1st r-f mixer. V31: H-f oscillator. V33: Doubler.	2J1AD4
V34	ELECTRON TUBE: diode; glass envelope; 5 terminations, wire type, located on bottom; subminiature cold cathode voltage regulator; type 5783.	Voltage regulator.	2J5783
V32, V51 thru V53, V81 thru V87, V121 thru V124	ELECTRON TUBE: pentode; glass envelope; 5 terminations, wire type, located on bottom; subminiature pentode; type 5678.	V32: Tripler. V51: 7.8 mci-f amplifier. V52: 2d mixer. V53: 2d h-f oscillator. V81: 1st 455-kc amp-lifier. V82: 2d 455-kc amplifier. V83: 3d 455-kc amplifier. V84: 4th 455-kc amp-lifier. V85: 5th 455-kc amp-lifier. V86: 1st limiter. V87: 2d limiter. V121: 1st audio amp-lifier. V123: Noise amplifier. V124: Squelch.	2J5678
V122	ELECTRON TUBE: pentode; glass envelope; 7 terminations, wire type, located on bottom; miniature audio power amplifier; type 6AK6.	Audio power amplifier.	2J6AK6
V125	ELECTRON TUBE: pentode; glass envelope; 5 terminations, wire type, located on bottom; subminiature power amplifier; type 5672.	Squelch.	2J5672
Z251	FILTER, bandpass: ± 35 kc cutoff; 455 kc operating freq; 440 to 470 kc bandwidth; 5-19/32 in. lg x 1-31/32 in. wd x 2-17/32 in. h o/a; rectangular metal	I-f bandpass filter.	3Z1892-29.3

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	case; hermetically sealed; end with leads marked "1" and "2".		
FL82	FILTER, direct current power: capacitor and iron core coil type; 3 capacitors 15,000 uuf, 100 v; 4 of 2 uh and 2 of 1.5 uh iron core inductors; 1.3 v dc, 1.2 amp; 5 in. lg x 5/8 in. wd x 1-1/4 in. h o/a; inclosed in case; rectangular shape, metal; 6 terminations, wire lead type, located on bottom; filled with potting compound.	Filament filter for 2nd if.	3Z1892-29.4
FL81	FILTER, i-f bypass: 17/32 in. lg x 9/32 in. h x 7/64 in. thk; cased, rectangular phenolic coating; term. mtd; 3 wire lead type term.; printed circuit type; uses one 47,000 ohm resistor and two 100 uuf capacitors.	455-kc i-f filter.	3Z1892-29.5
Z252	FILTER, RF: 455 kc; 1-15/16 in. lg x 1-7/16 in. wd x 1-17/32 in. h; cased, rectangular, steel; 3 solder lug type term.	R-f filter for V51 and V52 filaments.	3Z1892-29.2
H1, H81, H121	GRIP, handle: rectangular shape; 2-3/64 in. lg x 1-5/16 in. wd x 7/64 in. thk; 1 in. between ends; Motorola Inc. Part No. 255B1003.	H1: RF, pull-out handle. H81: 2d i-f pull out handle. H121: Audio and squelch pull out handle.	2Z4882A-7
H31, H51	GRIP, handle: rectangular shape; 1-19/32 in. lg x 1-5/16 in. wd x 7/64 in. thk; 5/8 in. between ends; Mfr, Motorola Inc., Part No. 255B1001.	H31: Oscillator, pull-out handle. H51: Pull-out handle for 1st i-f.	2Z4882A-9
H267	GRIP, handle: rectangular shape; 1-1/2 in. lg x 31/32 in. wd x 7/16 in. thk; 2 mtg holes .156 in. dia on 1-3/16 in. mounting centers; Motorola, Inc. Part No. 255B1007.	Grip for removing connector P251.	2Z4882A-8
H288	HOLDER, spring: corrosion resistant steel; passivated; holds cover by spring tension, two .101 in. mtg holes 1.562 in. apart; attached to latch handle located high on back plate of radio receiver.	Hold-down spring for top cover of radio receiver.	2Z5042-141
H59	INSULATOR, washer: nylon; rd; flat, MBCA Ref Dwg Group 9 D, 0.250 in.; H, .125 in.; T, .031 in.	Insulating washer.	3G385-151
H285	KNOB: rd; steel; yellow tint; designed to accommodate shaft double flattened, .250 in. wd x .187 in. h; .250 in. d shaft hole; pin; .600 in. dia, .250 in. thk; slotted head .078 in. wd by .125 in. d, straight knurled edge.	Part of lock-in assembly.	2Z5822-807
E31	OVEN, crystal: 1 crystal unit; AC 24.2 v and 6.3 v, 60 cyc, ac; single phase; 6 w at 24.2 v; 6.5 w at 6.3 v; 8 term., pin type, located on bottom; aluminum case; 1-13/32 in. h, 1-1/4 in. dia excluding term.; mts in octal socket; accommodates plug-in thermostat.	Crystal oven.	2Z6897-7

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
H259	PIN, locating: brass, nickel finish; cylindrical shape; 9/16 in. lg x 1/4 in. across flats approx o/a; 6-32 thd x 1/4 in. d mtg hole located axially at one end; one end tapered and the other end has hex. head.	Positions plug-in unit.	6L3943-9
A 5	PLATE, cover: aluminum alloy, iridite finish; rectangular; 2.531 in. lg x 1.906 in. wd x .781 in. d o/a excluding connectors; has integral bracket for recessed mtg of term. plug; Motorola Inc., Part No. 264B1212.	R-f plug-in unit bottom cover plate.	2Z7090-338
A 32	PLATE, cover: aluminum alloy, iridite finish; rectangular; 2.531 in. lg x 1.453 in. wd x .758 in. d o/a; has integral bracket for recessed mtg of connector plug; Motorola Inc., Part No. 264B1217.	Local oscillator bottom plate assembly.	2Z7090-339
A 52	PLATE, cover: plate, aluminum alloy, iridite finish; rectangular; 2.531 in. lg x 1.453 in. wd x .781 in. d o/a excluding connectors; has integral bracket for recessed mtg of term. plug; Motorola Inc., Part No. 264B1213.	1st i-f plug-in unit bottom cover.	2Z7090-336
A 82	PLATE, cover: aluminum alloy, iridite finish; rectangular; 2.531 in. lg x 1.906 in. wd x .781 in. d excluding connector; has integral bracket for recessed mtg of term. plug; Motorola Inc. Part No. 264B1214.	2nd i-f plug-in unit bottom cover.	2Z7090-337
H89	POST, spacing: support and fastener; brass, cad pl and chromated; hex. rod shape; 3/4 in. lg x 5/32 in. wd across flats; 4-40 tapped hole through axis.	Supports cover E81 and fastens one end potted filter FL82.	2Z7259-261
Z7	RECEIVER SUBASSEMBLY: c/w 1 chassis, 3 subminiature tubes, 6 coil assemblies, 1 fourteen cont plug, 3 r-f connectors; 7 in. lg x 2 in. wd x 2-5/8 in. h o/a; mts in drawer type plug-in assembly; fungi & moisture resistant; tropicalized; connectors positioned to avoid improper placement of unit; unit fully inclosed in metal sleeve.	Complete r-f amplifier plug-in assembly.	2C4049-3
Z37	RECEIVER SUBASSEMBLY: c/o 1 chassis, 1 crystal oven, 3 subminiature tubes, 4 coil assemblies, 1 fourteen-cont plug, 1 r-f connector; 7 in. lg x 1-1/2 in. wd x 2-5/8 in. h; mts in drawer type plug-in assembly; fungi and moisture resistant; tropicalized; connectors arranged to avoid improper placement of unit; unit fully inclosed in metal sleeve.	Complete local oscillator plug-in assembly.	2C4049-2
	RECEIVER SUBASSEMBLY: c/o 1 chassis, 1 crystal, 3 subminiature tubes, 5 coil assemblies, 1 fourteen-cont plug; 2 rf connectors; 7 in. wd x 2-5/8 in. h; mts in drawer type plug-in assembly; fungi and moisture resistant; tropicalized; connectors arranged to avoid improper placement of unit; unit fully inclosed in metal sleeve.	Complete 1st i-f amplifier plug-in assembly.	2C4049-6

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
Z83	RECEIVER SUBASSEMBLY: c/o 1 chassis, 7 sub-miniature tubes, 2 coil assemblies, 1 transformer, 2 filter networks, 1 fourteen contact plug, 1 r-f connector; 7 in. lg x 2 in. wd x 2-5/8 in. h; mts in drawer type plug-in assembly fungi and moisture resistant; tropicalized; connectors arranged to avoid improper placement of unit; unit fully inclosed in metal sleeve.	Complete 2nd i-f amplifier plug-in assembly.	2C4049-5
Z121	RECEIVER SUBASSEMBLY: c/o 1 chassis, 4 sub-miniature tubes, 1 miniature tube, 1 potentiometer, 1 term. board, 1 transformer, 1 fourteen-contact plug; 7 in. lg x 2 in. wd x 2-5/8 in. h; mts in drawer type plug-in assembly fungi and moisture resistant; tropicalized connector arranged to avoid improper placement of unit; unit fully inclosed in metal sleeve.	Complete audio amplifier and squelch plug-in assembly.	2C4049-4
Z253	RECEIVER SUBASSEMBLY: 1 honey combed assembly with receptacles to receive plug-in units, 1 compartment with receptacles to receive power supply, 1 wired base assembly, 1 assembly bottom cover, 1 assembly top cover, 1 power supply cover, 14 in. lg x 5-3/4 in. wd x 8-1/2 in. h; mts in standard case; fungi & moisture resistant tropicalized; connectors arranged to avoid improper placement of units; exterior voltage check points.	Receiver base assembly.	2C4049-1
R1, R11, R53, R54, R57, R82, R83, R85, R94, R96, R106, R107, R134	RESISTOR, fixed: comp; 100,000 ohms $\pm 10\%$ not tapped; 1/2 w power dissipation; JAN Type No. RC20BF104K.	R1: Antenna ground return. R11: V3 grid decoupling. R53: V51 Screen grid voltage dropping. R54: V51 B+ voltage dropping. R57: Broadens bandpass of Z55. R82: V81 Control grid bias. R83: V81 Screen grid voltage dropping. R85: V82 Control grid bias. R94: V84 Screen grid voltage dropping. R96: V85 Control grid bias. R106: CR81 load resistor. R107: CR82 load resistor. R134: V123 plate load.	3RC20BF104K
R4	RESISTOR, fixed: comp; 3.3 megohms $\pm 10\%$; not tapped; 1/2 w power dissipation; Spec Type No. RC20BF335K.	R4: V2 grid resistor.	3RC20BF335K

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R3	RESISTOR, fixed: comp; 6800 ohms $\pm 10\%$; not tapped; 2 w power dissipation; Spec Type No. RC42BE682K.	V1 plate voltage dropping.	3RC42BE682K
R5, R39	RESISTOR, fixed: comp; 10,000 ohms $\pm 10\%$; not tapped; 2 w power dissipation; Spec Type No. RC42BE103K.	R5: V2 and V3 plate voltage dropping. R39: V33 plate and screen grid voltage dropping.	3RC42BE103K
R6, R7, R34, R40, R51, R52, R55, R59, R81, R99, R101, R108, R125, R131, R146, R148	RESISTOR, fixed: comp; 1 megohm $\pm 10\%$; not tapped; 1/2 w power dissipation; Spec Type No. RC20BF105K.	R6: LO test point isolation. R7: V3 grid bias. R34: Isolates V33 control grid from test point No. 2. R40: Isolates V31 control grid from test point No. 1. R51: V51 control grid bias. R52: V51 control grid to test point RF isolation. R55: V52 control grid bias. R59: V53 control grid bias. R81: Isolates V81 control grid from test point No. 3. R99: Isolates V85 control grid from test point No. 4. R101: Isolates V87 control grid test point. R108: Isolates discriminator high audio output from test point No. 5. R125: V121 screen grid dropping. R131: V123 grid bias. R146: V125 dc coupling. R148: V124 grid current limiting.	3RC20BF105K
R8, R112, R113	RESISTOR, fixed: comp; 1000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; Spec Type No. RC20BF102K.	R8: V3 plate voltage dropping. R112: CR81 balancing resistor. R113: CR82 balancing resistor.	3RC20BF102K
R9, R10, R92	RESISTOR, fixed: comp; 10,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; Spec No. JAN-R-11, Type No. RC20BF103K.	R9: V1 screen grid voltage dropping. R10: V2 screen grid voltage dropping. R92: V83 plate and screen dropping.	3RC20BF103K

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R31, R35, R38, R87, R93, R98, R102, R121, R126, R129, R135, R136, R147, R252	RESISTOR, fixed: comp; 220,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation.	R31: V31 control grid bias. R35: V32 control grid bias. R38: V33 control grid bias. R87: V83 control grid bias. R93: V84 control grid bias. R98: V86 control grid bias. R102: V87 control grid bias. R121: V121 de emphasis resistor. R126: V121 de emphasis resistor. R129: V123 input filter. R135: V123 grid circuit filter. R136: Squelch control voltage divider. R147: V125 voltage divider. R252: Squelch dropping.	3RC20BF224K
R32, R133	RESISTOR, fixed: comp; 68,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF683K.	R32: V31 screen grid dropping. R133: V123 voltage divider.	3RC20BF683K
R33	RESISTOR, fixed: comp; 15,000 ohms $\pm 10\%$; not tapped; 1 w power dissipation; JAN Spec Type RC30BF153K.	Isolates VR31 plate from B+.	3RC30BF153K
R36	RESISTOR, fixed: comp; 2200 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF222K.	V31 plate voltage dropping.	3RC20BF222K
R37, R100	RESISTOR, fixed: comp; 4700 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF472K.	R37: V32 plate and screen grid voltage dropping. R100: B+ voltage dropping.	3RC20BF472K
R56, R60, R84, R86, R95, R97,	RESISTOR, fixed: comp; body style No.14, MBCA Ref Dwg Group 2; 47,000 ohms $\pm 10\%$; not tapped; 1/2 w dissipation; JAN Spec Type RC20BF473K.	R56: V52 screen grid dropping. R60: V53 B+ decoupling. R84: V81 plate load. R86: V82 plate load. R95: V84 plate load. R97: V85 plate load.	3RC20BF473K

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R132, R140		R132: V123 screen grid dropping. R140: V124 screen grid dropping.	
R88	RESISTOR, fixed: comp; 10 megohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF106K.	Agc circuit voltage divider (connected to V84 & V85 screen grids).	3RC20BF106K
R89	RESISTOR, fixed: comp; 6800 ohms $\pm 5\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF682K.	V83 plate and screen grid dropping resistor.	3RC20BF682K
R103, R58	RESISTOR, fixed: comp; 33,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF333K.	R103: V86 plate and screen dropping resistor. R58: B+ decoupling filter resistor.	3RC20BF333K
R104, R141	RESISTOR, fixed: comp; 22,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF223K.	R104: V86 and V87 B+ voltage dropping. R141: V124 screen voltage divider.	3RC20BF223K
R111, R130, R137, R139, R142, R149, R254	RESISTOR, fixed: comp; 470,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF474K.	R111: Couples test point No. 4 and control grid of V85 to Agc circuit. R130: V123 hi-pass filter. R137: V123 dc coupling. R139: V124 dc coupling. R142: V124 plate load. R149: V125 plate load. R254: Decoupling in agc circuit (at TB252).	
R122	RESISTOR, fixed: comp; 2.2 megohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF225K.	V121 grid leak resistor.	3RC20BF225K
R114, R123	RESISTOR, fixed: comp; 47 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF470K.	R114: V121 Part of d-c bias voltage divider network for discriminator. R123: V121 hum balancing resistor.	3RC20BF470K
R109, R124	RESISTOR, fixed: composition; 100 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN Spec Type RC20BF101K.	R109: Part of discriminator bias voltage divider. R124: V121 hum balancing resistor.	3RC20BF101K
R128	RESISTOR, fixed: comp; 330,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN spec type RC20BF334K.	V121 and V122 audio decoupling resistor.	3RC20BF334K

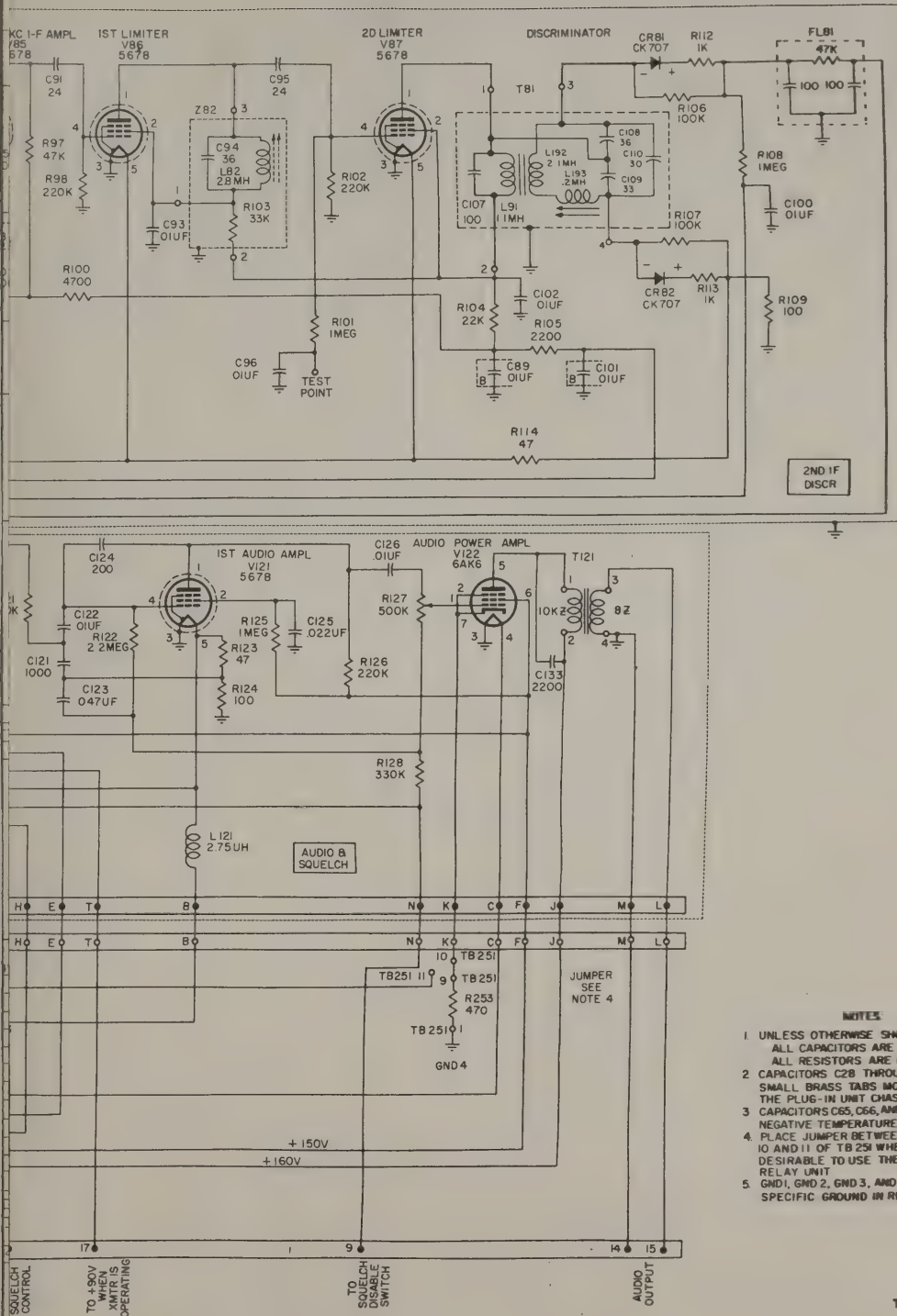
2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R138, R145, R150	RESISTOR, fixed: comp; 680,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN spec type RC20BF684K	R138: Part of voltage divider to grid of V124. R145: V125 voltage divider. R150: V125 screen grid dropping.	3RC20BF684K
R2, R143	RESISTOR, fixed: comp; 1.5 megohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN type RC20BF155K	R2: V1 grid return. R143: V124 - V125 coupling.	3RC20BF155K
R144	RESISTOR, fixed: comp; 15,000 ohms $\pm 10\%$; not tapped; 1/2 w power dissipation; JAN spec type No. RC20BF153K.	V125 grid circuit voltage divider.	
R251	RESISTOR, fixed: comp; 10 ohms $\pm 10\%$; not tapped; 1 w power dissipation; JAN spec type RC30BF100K.	Filament shunt.	3RC30BF100K
R253, R271	RESISTOR, fixed: comp; 470 ohms $\pm 10\%$; not tapped; 1 w power dissipation; JAN spec type RC30BF471K.	R253: V122 cathode bias resistor. R271: Controls degeneration of V122.	3RC30BF471K
R127	RESISTOR, variable: rotating brush type; one sect.; 500,000 ohms $\pm 10\%$; 1/2 w nominal power rating; Chi Tel Supp Co #65(LT)X3540.	V122 volume control.	3Z7350-146
H251 thru H256	RETAINER, fastener stud: steel, cadmium plated and chromated 1 in. lg x 33/64 in. wd x 3/16 in. thk; two .098 in. dia mtg holes, spaced .750 in. C to C.	H251: Retainers for cover fastener studs.	6Z7852-9
H2, H36 thru H39, H56 thru H58, H82 thru H88, H122 thru H125	RING, retainer: brass rectangular ring .460 in. x .264 in. wd x .012 in. thk o/a; mts by ctr hole .360 in. lg x .184 in. wd; has 4 internal points for gripping tube socket.	H2: Hold tube socket in chassis. H3, H36 thru H39, H56 thru H58, H82 thru H88, H122 thru H125: Holds tube in socket.	2Z7858-343
H4	RING, retainer: round ring .455 in. OD, .360 in. ID x .050 in. thk o/a; mts ctr hole.	Holds tube socket in chassis.	2Z7858-342
E20, E21	SHIELD, electron tube: phosphor bronze; cylindrical shape; 1-3/16 in. lg, 3/8 in. dia o/a; bracket mtd; silver pl, has slot for attaching to mtg bracket.	Shields electron tube.	2Z8304.364
E121	SHIELD, electron tube: copper or brass; cylindrical shape; .430 in. dia, 1-3/4 in. h; friction mtd; nickel pl, Motorola Part No. 926R102.	Miniature tube shield.	2Z8304.276

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
E13, E65, E86	SHELL, electrical connector: brass; silver pl finish cylindrical shape; .750 in. lg, .250 in. OD, .152 in. and 0.204 in. ID; one end thd #1/4-32, 5/16 in. lg; two holes .089 in. dia, 180° apart.	E13: Conduit and ground- ing connection for r-f cable. E65: Connects coaxial cable to chassis. E86: Conduit and ground- ing connection for r-f cable.	2Z8276-113
E22, E72, E89	SHELL, electrical connector: brass; silver pl finish; hex. shape 37/64 in. lg x 7/16 in. wd x 15/32 in. o/a; silver soldered; coaxial line hood; Motorola Part No. 215T1213.	Angle hoods for coaxial connectors.	2Z8276-112
XV1	SOCKET, electron tube: 8 cont beryllium copper; gold pl; max cont present; subminiature; does not incl metal shock shield; incl ctr shield .125 in. OD; round with 2 flat sides; .400 in. dia, .330 in. wd across flats, .281 in. h; molded phenolic body; retainer ring mtg dim. .360 in. dia chassis hole.	Mounts tube V1.	2Z8670.60
XV2, XV31, XV32, XV33, XV34, XV51 thru XV53, XV81 thru XV87, XV121 thru XV125	SOCKET, electron tube: 5 cont; beryllium copper; gold pl; subminiature; rectangular shape; .350 in. lg x .218 in. wd x .281 in. h excluding term.; molded phenolic; retainer ring mounting dim .159 in. wd x .353 in. lg hold required.	XV2: Socket for second radio frequency tube V2. XV3: Socket for first mixer tube V3. XV31: V31 oscillator tube socket. XV32: V32 trigger tube socket. XV33: V33 doubler tube socket. XV34: V34 oscillator tube socket. XV51: Socket for inter- mediate frequency tube V51. XV52: V52 second mixer tube socket. XV53: V53 second oscil- lator tube socket. XV81: V81 1st amplifier and 2nd IF tube socket. XV82: V82 2nd amplifier and 2nd IF tube socket. XV83: V83 3rd amplifier and 2nd IF tube socket. XV84: V84 4th amplifier and 2nd IF tube socket. XV85: V85 5th amplifier. XV86: V86 first limiter tube socket. XV87: V87 2nd limiter tube socket. XV121: V121 1st audio tube socket. XV123: V123 noise gen- erator tube socket. XV124: V124 squelch tube socket.	2Z8675.107

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
T121	term. nickel pl mtg stud; 5/8 in. lg 1/4 in. dia; mts by single stud with 4-40 thd 7/32 in. lg. TRANSFORMER, audio: plate type; 10,000 ohms pri 8 ohms sec'd; untapped; pri rated 12 ma; 1000 v rms, 60 cycles-per-second test voltage; 1/2 w max audio operating level; 34 to 1 ratio of turns to sec'd; between -2 db and -4 db at 100 cyc and not more than -1 db at 3500 cyc freq response; hermetically sealed; schematic diagram marked on case.	Audio output transformer.	2Z9612.362
T81	TRANSFORMER, discriminator: 455 kc peak freq; shielded; 7/8 in. lg x 7/8 in. wd x 1-7/8 in. h; phenolic coil form, powdered iron core; tuned secondary only; adjustable iron core tuning.	Discriminator.	2Z9643.490



NOTES

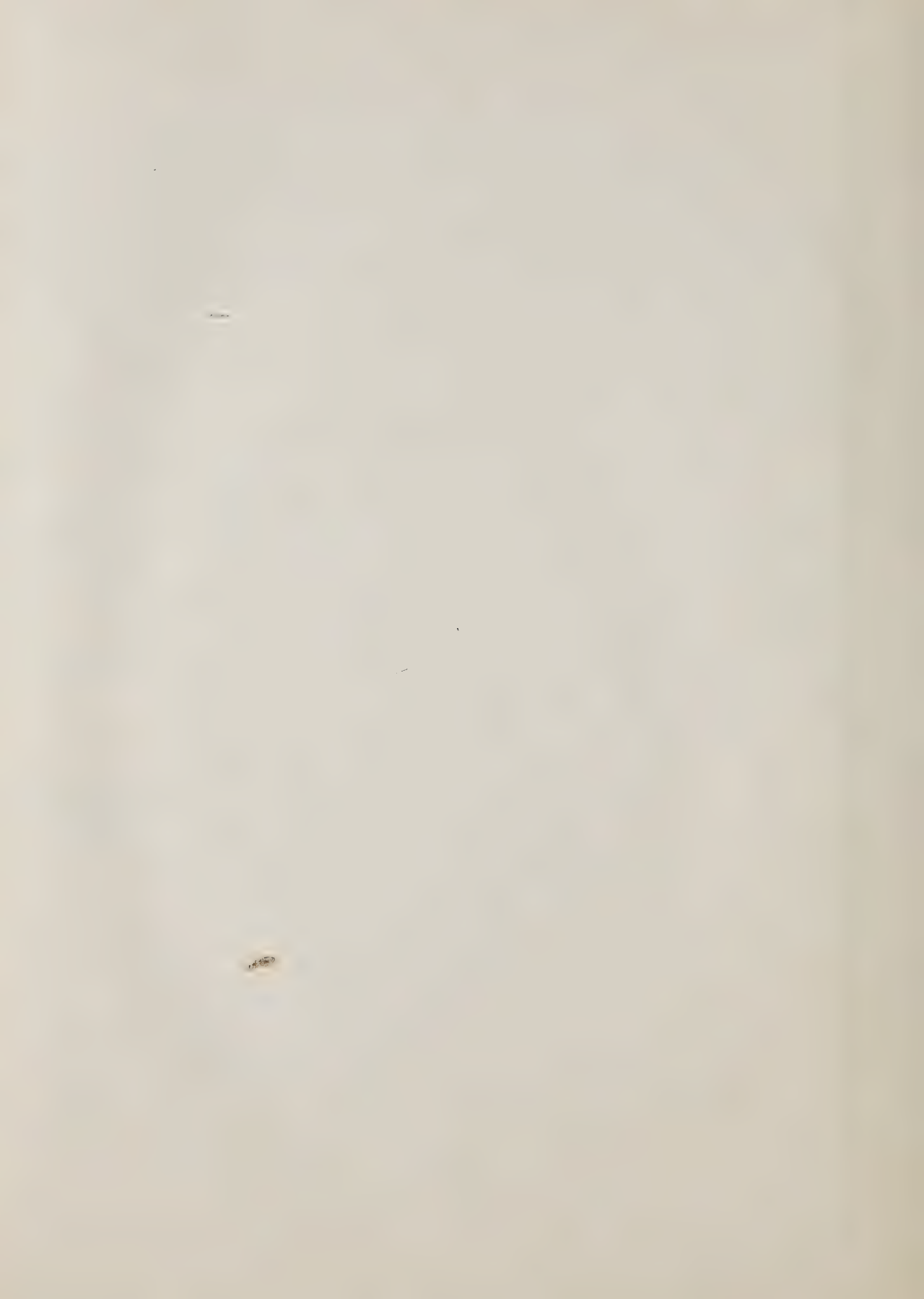
1. UNLESS OTHERWISE SHOWN ALL CAPACITORS ARE IN UUF. ALL RESISTORS ARE IN OHMS
2. CAPACITORS C28 THROUGH C31 ARE SMALL BRASS TABS MOUNTED BELOW THE PLUG-IN UNIT CHASSIS
3. CAPACITORS C65, C66, AND C67 HAVE A NEGATIVE TEMPERATURE COEFFICIENT
4. PLACE JUMPER BETWEEN TERMINALS 10 AND 11 OF T8251 WHEN IT IS DESIRABLE TO USE THE SQUELCH RELAY UNIT
5. GND1, GND2, GND3, AND GND4 SPECIFIC GROUND IN RECEIVER BASE

TM 5092-500

Figure 76. Radio Receiver R-394/U, schematic diagram.

2. Identification Table of Parts (contd)

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
T121	term. nickel pl mtg stud; 5/8 in. lg 1/4 in. dia; mts by single stud with 4-40 thd 7/32 in. lg. TRANSFORMER, audio: plate type; 10,000 ohms pri 8 ohms sec; untapped; pri rated 12 ma; 1000 v rms, 60 cycles-per-second test voltage; 1/2 w max audio operating level; 34 to 1 ratio of turns to sec; between -2 db and -4 db at 100 cyc and not more than -1 db at 3500 cyc freq response; hermetically sealed; schematic diagram marked on case.	Audio output transformer.	2Z9612.362
T81	TRANSFORMER, discriminator: 455 kc peak freq; shielded; 7/8 in. lg x 7/8 in. wd x 1-7/8 in. h; phenolic coil form, powdered iron core; tuned secondary only; adjustable iron core tuning.	Discriminator.	2Z9643.490



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